7. Alternative Approaches and Scenarios to Close Supply/Demand Gap

As shown in Sections 5 and 6, the projected water demand for Jemez y Sangre Water Planning Region cannot be met by current water supply conditions. This section explains how the JySWPC developed alternative approaches to help bridge the supply/demand gap and then combined these approaches to come up with possible scenarios for various subregions.

7.1 Description of the Alternative Selection Process

Beginning in February 2001, participants were invited to public meetings to help the JySWPC develop alternatives for meeting future regional water demand. Approximately 22 citizens from Velarde, Tesuque, Galisteo, Santa Fe, and Los Alamos met with the members of the JySWPC to form the Alternatives Subcommittee. The subcommittee brainstormed ideas and worked for several months to develop a system of evaluating the alternatives. Numerous charts were made to rank the alternatives numerically or color code these in an effort to synthesize the information. However, the subcommittee recognized its limitations to evaluate all aspects—technical, legal, environmental, and financial—of each alternative. Using an additional source of funding, the subcommittee decided to retain a team of experts to evaluate the various aspects of the alternatives through an open bidding process.

The committee originally grouped the alternatives into two categories: (1) alternatives that would reduce demand and (2) alternatives that would increase supply. Some alternatives were actually methods for implementing another alternative. For instance, under the broad heading of water conservation there are numerous methods to reduce indoor or outdoor use; all of these methods are considered under the "demand reduction" alternative.

The selected team of experts, coordinated by DBS&A, developed a series of white papers. These white papers were presented by the experts at a charrette, held by the JySWPC in February of 2002. During the charrette, the alternatives were discussed and evaluated as to their applicability to the region. Comments were incorporated and the white papers, included as Appendix F of this plan, were revised in July 2002. As the results of the charrette were synthesized and the subcommittee attempted to prioritize and rank the alternatives for meeting the needs of the region, the alternatives were regrouped into five categories instead of the original two. Table 25 shows the final grouping of alternatives considered.

The subcommittee recognized that the water plan should address the issue of sustainability of existing supplies as well as meeting the project water supply/demand gap. Thus, although some alternatives do not specifically address how to meet the projected supply/demand gap, they may still be worth pursuing because they will help protect or restore existing supplies. The issues are very complex, as described in detail in the white papers (Appendix F). For example, an alternative that addresses ditch lining may help improve irrigation efficiency. It will not, however, generate "new" water that can be utilized for other purposes because water rights must be acquired to divert water for a new use. Lining a ditch may increase the ability of that ditch to meet its associated demands for a longer period of time, but it will likely reduce recharge to wells in the area or return flow to the stream.

Each of the 21 white papers included in Appendix F is structured as follows:

- Summary of the alternative
- Technical feasibility
- Financial feasibility
- Legal feasibility
- Effectiveness in either increasing the available supply or reducing the projected demand
- Environmental implications
- Socioeconomic impacts
- Actions needed to implement/ease of implementation
- Summary of advantages and disadvantages

Table 25 shows the final grouping of the alternatives, which differs from the original organization during preparation of the white papers. As a result, some of the white papers address multiple alternatives (as shown on Table 25). For example, efficiency measures such as ditch lining, piping of SJC water, and the use of regional authorities for improved management were

Table 25. Jemez y Sangre Regional Water Plan Alternatives
Page 1 of 3

Alternative	Description
Restore and protect supply for existing demand (agriculture, municipal/industrial, domestic) and the environment	
Restore and manage forests, piñon-juniper woodlands, and riparian systems	• Evaluates potential yield increases due to management of each ecosystem
	• Discusses water quality issues
Manage storm water	• Considers three options ▪ Catchment basins in tributaries ▪ Water harvesting ▪ Injecting surface water for later retrieval
Increase precipitation, runoff, and infiltration through cloud seeding	• Examines both winter and summer cloud seeding programs
	• Discusses current cloud seeding programs in other locations
Manage well fields	• Considers the following options: ▪ Improving management of existing well fields ▪ Installing new municipal/industrial wells ▪ Creating new community water systems ▪ Improving existing community water systems
Conjunctive use of surface water and groundwater rights	• Evaluates combining surface and groundwater rights to allow for use of surface water in wet years and groundwater in dry years
	• Does not consider physical injection of surface water
Removal of trace constituents from groundwater	• Presents maps showing locations where concentrations of trace constituents in groundwater exceed drinking water standards
	• Discusses treatment options for removal of trace constituents
Remove sediments from reservoirs	• Considers removing sediment to increase storage capacity
Groundwater desalination	• Examines incidence of saline water in the region
	• Describes treatment technologies for desalination
Improve system efficiency	
Wastewater reuse	• Considers treatment options, regulatory standards, and the following disposal options: ▪ Discharge for return flow credits ▪ Injection as artificial recharge ▪ Reuse for irrigation, turf, etc. ▪ Reuse in manufacturing and industry

Table 25. Jemez y Sangre Regional Water Plan Alternatives
Page 2 of 3

Alternative	Description
Replace septic tanks	• Considers replacing septic tanks with regional treatment systems or improved on-site treatment systems
	• Discusses water quality and return flow credit issues
Line ditches	• Considers lining or piping of irrigation delivery systems to reduce losses
Repair leaks in water systems	• Discusses repair and maintenance of water systems to reduce losses
Regional water system authority	• Evaluates establishment of a regional water authority to better manage water resources
Aquifer storage and recovery	• Describes methods of recharging groundwater with surface water
	• Considers both injection of surface water (storm water alternative) and of treated wastewater
Optimize reservoir management	• Considers storing water at higher elevations to reduce evapotranspiration
Pipe water from Heron or Abiquiu	• Discusses delivery of San Juan-Chama water through a regional pipeline
Mitigate drought	
Bank water	• Considers the development of administrative water banks
	• Does not consider physical injection of surface water
Emergency conservation	• Describes the process for developing a drought plan, including drought monitoring, response, and mitigation
	• Discusses potential drought responses including short-term water restriction/conservation measures
Reduce demand	
Manage growth and land use	• Considers three mechanisms for controlling growth ▪ Geographical limits ▪ Project constraints (tied to availability of water) ▪ Numerical limits
Water conservation	• Considers water conservation measures including ▪ Indoor plumbing fixtures ▪ Landscape ▪ Industrial
	• Discusses mechanisms for effectively implementing conservation programs

Table 25. Jemez y Sangre Regional Water Plan Alternatives
Page 3 of 3

Alternative	Description
Increase supply by adding or moving water rights to municipal/industrial uses	
Utilize San Juan-Chama Water	• Considers using San Juan-Chama water from the existing contracts or leasing Jicarilla Apache SJC water, fully utilizing existing contracts by obtaining return flow credits for wastewater • Discusses consumptively using 100% of the San Juan-Chama Project water by applying it to beneficial use
Purchase surface water in the marketplace	• Considers the possibilities of purchasing primarily agricultural surface water rights within and outside the region • Describes mechanisms for transfer of water rights
Transfer water across Otowi Gage	• Considers purchasing or leasing surface and/or groundwater rights above Otowi gage and transferring those rights to locations below Otowi gage
Drill domestic/municipal supply wells	• Evaluates groundwater alternatives, including ▪ Installing new municipal/industrial wells ▪ Installing new domestic wells ▪ Creating new community water systems ▪ Improving existing community water systems
Speculative alternatives:	• Line ditches, transfer to domestic use
	• Reappropriate water above Otowi Gage up to 1929 conditions of the Rio Grande Compact
	• Appropriate flood flows during spill years
	• Build new reservoirs

considered in the white paper entitled "Efficiently Convey Water." A list of all the white papers is provided at the beginning of Appendix F.

The JySWPC sent out a survey to better understand what, if any, activities related to the evaluated alternatives were currently taking place. A copy of this survey is provided in Appendix G and results of the survey are summarized in Appendix G, Table G-1. These results show that many of the alternatives, even the most controversial (manage growth and land use), are presently being pursued in the planning region.

Table 26 summarizes the recommended actions associated with each alternative. These actions relate to the recommendations provided in Section 8.2 and to the discussions in the relevant white paper(s). Viable alternatives listed under "Reduce Demand" and "Increase Supply" were used to develop scenarios that could help close the gap between supply and demand. These scenarios are discussed in the following section.

7.2 Scenarios for Closing Supply/Demand Gap

Each of the alternatives described in Section 7.1 and Appendix F were evaluated to determine their potential for assisting the region in meeting future water supply needs. To determine how alternatives or combination of alternatives help the region meet its future demands, several scenarios were developed. Originally, several scenarios illustrating extreme conditions (i.e., meet all future needs through growth management) were developed and presented to the public. Public comments were received during the October 2002 meetings and were used to help develop the scenarios presented in the section. This section is intended to give decision makers an idea of the projected water supply situation, describe some example scenarios for meeting the projected gap, and provide guidance on the options for developing other scenarios. To illustrate the scenarios, the ten sub-basins in the Jemez y Sangre Water Planning Region have been grouped into five subregions, as shown in Figure 50:

- *Northern Subregion:* Velarde, Santa Clara and Santa Cruz Sub-Basins
- *Aamodt Subregion*: Tesuque and Pojoaque-Nambe Sub-Basins
- *Santa Fe Subregion*: Santa Fe River, Caja del Rio, and North Galisteo Sub-Basins

Table 26. Alternatives, Conclusions, and Associated White Papers
Page 1 of 2

Alternative	Recommended Action [a]	White Paper Reference No. [b]
Restore and protect supply for existing demand (agriculture, municipal/industrial, domestic) and the environment		
Restore and manage forests, piñon-juniper woodlands, and riparian systems	Pursue (Recommendation 1).	1
Manage storm water	Pursue (Recommendation 2).	3
Increase precipitation, runoff, and infiltration through cloud seeding	Pursue pilot project (Recommendation 3).	8
Manage well fields	Pursue data collection and improved modeling and evaluate establishing critical management areas (Recommendations 4 and 5).	13
Conjunctive use of surface water and groundwater rights	Pursue (Recommendation 6).	2
Removal of trace constituents from groundwater	Pursue as required by law and consider regional systems to improve protection of human health (Recommendation 8).	4b
Remove sediments from reservoirs	Pursue in Santa Cruz Reservoir; investigate Nambe Reservoir (Recommendation 16).	5
Groundwater desalination	No action proposed because existing saline water is under the jurisdiction of the Office of the State Engineer.	4a
Improve system efficiency		
Wastewater reuse	Pursue (Recommendation 13).	7
Replace septic tanks	Pursue as appropriate (Recommendation 9).	11
Line ditches	Pursue where appropriate (Recommendation 15).	6
Repair leaks in water systems	Conduct audits and pursue (Recommendation 17).	6
Regional water system authority	Establish advisory boards as appropriate for implementation (Section 8.2.1, Recommendation to Create One or More Advisory Boards).	6
Aquifer storage and recovery	If excess water is available, pursue (Recommendation 18).	12
Optimize reservoir management	Pursue increased storage at Abiquiu (Recommendation 19).	5
Pipe water from Heron or Abiquiu	No action. Advantage is very slight compared to cost and impact to environment.	6
Mitigate drought		
Bank water	Pursue through consensus process as part of drought mitigation (Recommendations 20 and 24).	14
Emergency conservation	Measures already exist; pursue and maintain as needed (Recommendation 20).	20

[a] Recommended actions are outlined in Section 8.2.

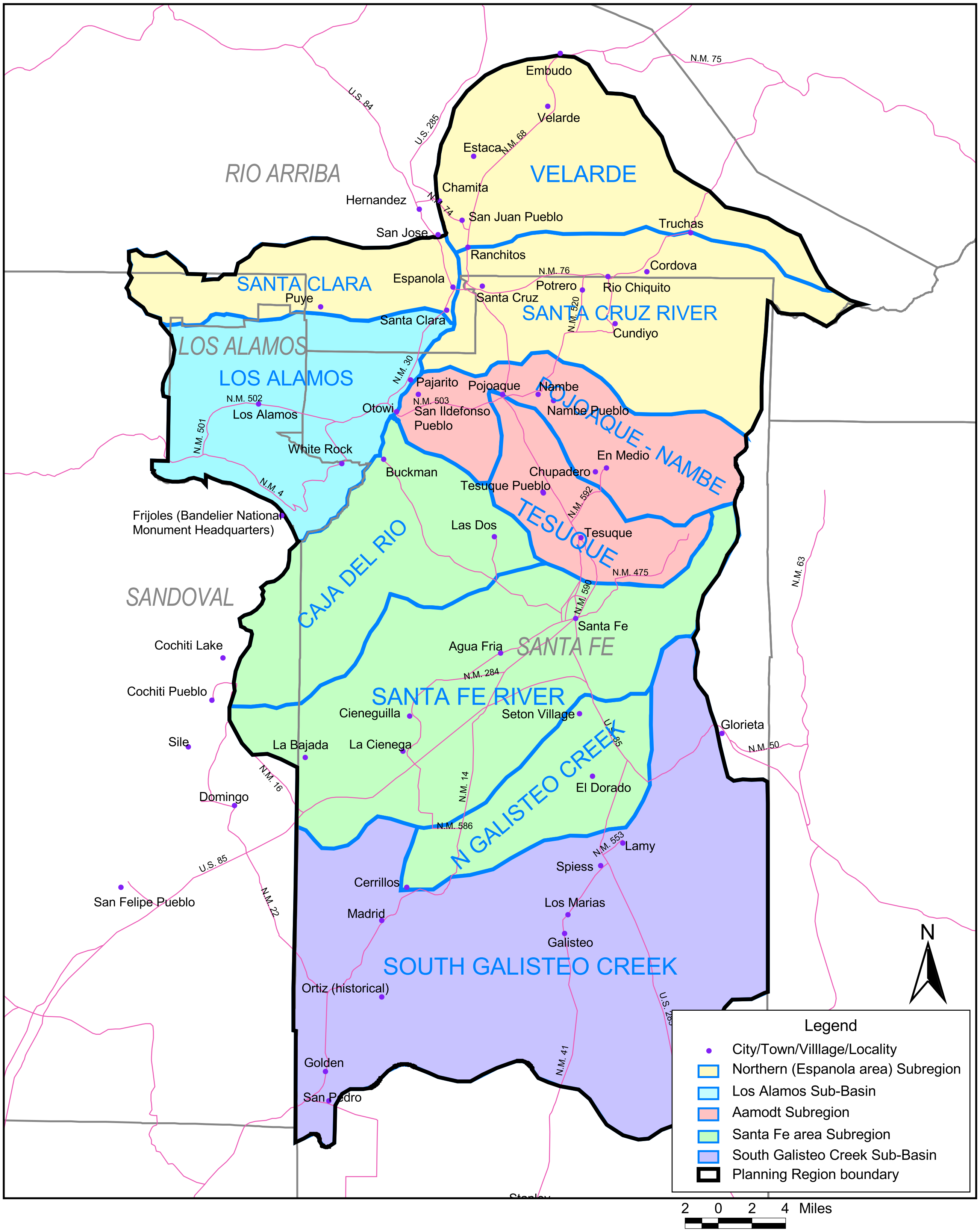
[b] White papers are available in Appendix F.

Table 26. Alternatives, Conclusions, and Associated White Papers
Page 2 of 2

Alternative	Recommended Action [a]	White Paper Reference No. [b]
Reduce demand		
Manage growth and land use	Pursue (Recommendation 22).	18
Water conservation	Pursue (Recommendation 21).	19
Increase supply by adding or moving water rights to municipal/industrial uses		
Utilize San Juan-Chama Water	Pursue use of unused contracts and return flow credits (Recommendation 23).	16
Purchase surface water in the marketplace	Pursue through consensus process (Recommendation 24).	15 and Area of Origin Paper in Appendix D3
Transfer water across Otowi Gage	Pursue through consensus process; however, compact issues exist (Recommendation 24).	17
Drill domestic/municipal supply wells	Proceed with Caution (Recommendations 4, 5, and 25).	13 and Critical Management Paper in Appendix D3
Speculative alternatives:		
Line ditches, transfer to community or municipal system	No action; adjudication is likely necessary to pursue.	6
Reappropriate water above Otowi Gage up to 1929 conditions of the Rio Grande Compact	No action recommended due to lack of consensus. Santa Fe County is pursuing this option.	10
Appropriate flood flows during spill years	Pursue where infrastructure exists (Recommendation 7).	9
Build new reservoirs	No action due to costs, need for water rights, and environmental issues, among others. Increase in storage at Abiquiu is preferable to building new reservoirs.	5

[a] Recommended actions are outlined in Section 8.2.

[b] White papers are available in Appendix F.



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JEMEZ Y SANGRE REGIONAL WATER PLAN

Jemez y Sangre Subregions

Figure 50

- *Los Alamos Sub-Basin*
- *South Galisteo Sub-Basin*

A series of scenarios have been developed for each of the subregions to show their vulnerability during drought periods. Each scenario shows a combination of alternatives that can be used to meet the projected demand gap under both average and drought conditions. For example, a scenario may include both conservation measures and the use of SJC water to meet the projected demand gap in the subregion. For the same scenario under drought conditions, however, there would be less SJC water available.

For comparison purposes, the same drought periods are used for each of the subregions and scenarios, as follows:

- *PDO Drought Years*: In the years 2000, 2010, and 2060 the average water supply under negative PDO years are presented. Historically, streamflow during negative PDO cycles (1948 to 1975) has averaged about 73 percent of the long-term average.

- *One-in-Ten Drought Years:* For the years 2020 and 2050, a one-in-ten year drought is presented. The 90 percent exceedance for streamflow (the amount that is met or exceeded during 90 percent of the years), was used as the base figure to estimate the surface supply during a one-in-ten year drought, which averages about 42 percent of the average flow. (This is a simplistic method of estimating water availability, as priority appropriation also plays a role in the amount of deficit in supply).

Average conditions were presented for the years 2030 and 2040. Charts were prepared for each of the subregions to provide information regarding basic options available to decision makers for closing the supply-demand gap. These option charts can be used to create scenarios other than those presented below; however, these charts are simplistic and do not represent the complexities and interconnections among alternatives.

7.2.1 Scenarios and Options for the Northern Subregion

Under the most-likely population projection provided by BBER (2000), the population of the Northern Subregion is projected to increase by approximately 28,200, from an estimated 29,600 in 2000 to an estimated 58,800 in 2060. The resultant increase in water demand could be as high as 4,230 afy in 2060, increasing from 4,442 in 2000 to 8,670 in 2060. Figure 51 shows the current sources of water supply and the projected increase in demand.

Figure 52 provides a visual aid for understanding how options can be combined to meet the projected gap between supply and demand. In this figure, incremental strategies for the implementation of alternatives for conservation, growth management, the purchase of agricultural water rights either below or above Otowi Gage, and allowing more domestic wells are represented by a square in the chart. The action indicated in any particular square represents a 10 percent reduction of the projected gap by the year 2060 and these actions are cumulative from left to right. Thus, the action to purchase 2,114 acre-feet of water rights represented by 5 squares (which would retire 682 acres of irrigated land) below Otowi Gage represents a 50 percent reduction in the overall supply/demand gap.

The alternative to utilize San Juan-Chama water is represented in a slightly different fashion than the other alternatives, with the first five squares (from left to right) representing incremental increases in the use of Española SJC water and the last five squares representing incremental increases in the use of San Juan Pueblo SJC water.

Figure 52 is useful for developing potential scenarios for closing the supply/demand gap, with some limitations. In particular, the options shown in Figure 52 and in the charts presented later for other subregions represent a simplified version of the actual options available to the region. For example, complexities such as the interconnection between conservation and return flow credits are oversimplified in this chart. Additionally, the charts approach the supply/demand gap at a regional level and do not attempt to address individual water rights ownership or the ability to implement projects. Nevertheless, the gap can conceptually be closed by implementing options whose squares total 100 percent. For example, the projected supply/demand gap in the Northern Subregion by 2060 could be closed through the scenarios described below.

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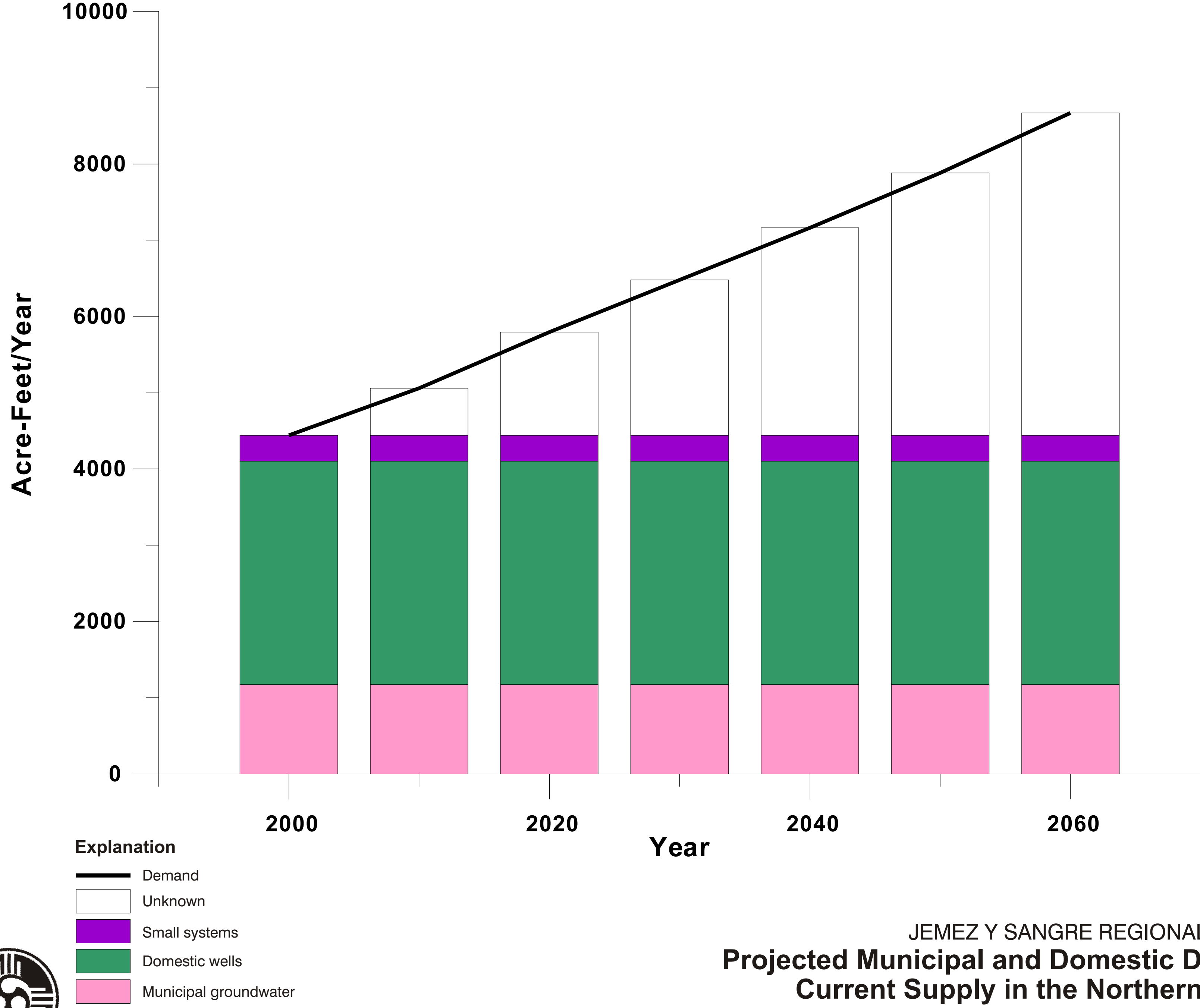

JEMEZ Y SANGRE REGIONAL WATER PLAN

Projected Municipal and Domestic Demand and Current Supply in the Northern Subregion

Figure 51

Percent	10	20	30	40	50	60	70	80	90	100
Acre-Feet	*423*	*846*	*1,269*	*1,692*	*2,115*	*2,538*	*2,961*	*3,384*	*3,807*	*4,230*
Conservation	Reduce ***NEW*** indoor and outside demand by 10%	Reduce ***NEW*** indoor and outside demand by 25%	Reduce ***ALL*** outside use and ***NEW*** inside use by 25%	Reduce ***ALL*** outside use by 50% and all ***NEW*** inside use by 25%	Reduce ***ALL*** outside use by 70% and all ***NEW*** inside use by 25%					
Growth Management	Reduce projected growth rate by 10%	Reduce projected growth rate by 20%	Reduce projected growth rate by 30%	Reduce projected growth rate by 40%	Reduce projected growth rate by 50%					
Purchase Agricultural Water Rights Below Otowi	136 acres of MRGCD (0.2% of agric. land)	273 acres of MRGCD (0.5% of agric. land)	409 acres of MRGCD (0.7% of agric. land)	545 acres of MRGCD (1% of agric. land)	682 acres of MRGCD (1.1% of agric. land)	818 acres of MRGCD (1.4% of agric. land)	955 acres of MRGCD (1.7% of agric. land)	1,091 acres of MRGCD (1.8% of agric. land)	1,227 acres of MRGCD (2.1% of agric. land)	1,363 acres of MRGCD (2.4 % of agric. land)
Purchase Agricultural Water Rights Above Otowi	325 acres (1.6% of JyS agric. land)	650 acres (3.2% of JyS agric. land)	975 acres (5% of JyS agric. land)	1,300 acres (6.5% of JyS agric. land)	1,600 acres (8% of JyS agric. land)	1,950 acres (10% of JyS agric. land)	2,280 acres (11% of JyS agric. land)	2,600 acres (13% of JyS agric. land)	2,927 acres (15% of JyS agric. land)	3,250 acres (16% of JyS agric. land)
Allow More Domestic Wells	2,000 more households on domestic wells	3,400 more households on domestic wells	5,100 more households on domestic wells							
Utilize San Juan-Chama Water [a]	Utilize Espanola SJC water	Utilize Espanola SJC water	Return flow credit on Espanola SCJ water	Return flow credit on Espanola SCJ water	Return flow credit on Espanola SCJ water	Utilize San Juan Pueblo SJC water	Utilize San Juan Pueblo SJC water	Utilize San Juan Pueblo SJC water	Utilize San Juan Pueblo SJC water	Utilize San Juan Pueblo SJC water

Select ten blocks, starting on the left, from a combination of alternatives to indicate the desired method of reducing the projected 2060 gap between supply and demand. (Selection of any one block requires selection of all blocks to the left in that alternative.)

100% = 4,230 acre-feet

(hatched) = No further reduction in supply/demand gap is viable with this alternative

(yellow) = Uncertain due to the requirement to modify compact accounting

[a] Use of Espanola and San Juan Pueblo SJC water are two separate options (each can be implemented independently of the other). Higher percentages reflect use of larger amounts of San Juan-Chama water.

JEMEZ Y SANGRE REGIONAL WATER PLAN

Options for Meeting Projected Supply/Demand Gap in the Northern Subregion

Figure 52

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In the Northern Subregion, Scenario 1 would close the supply-demand gap for municipal and domestic uses through (1) using available SJC water, (2) reducing water demand through conservation, and (3) transferring some water from agriculture to urban use, as shown in Figure 53. This scenario could be represented on the options chart (Figure 52) by filling in the first square on the left for the conservation scenario, the first four squares on the left for the purchase water rights above Otowi Gage and five squares for the utilize SJC water alternative. However, during periods of drought, surface water supplies such as the SJC water and irrigation rights may not be available and a gap between supply and demand would occur, as illustrated for 2050 in Figure 54 (during a projected one-in-ten year drought). Figure 55 shows how Scenario 1 could be used to meet all of the water demand (including agriculture). Note that the total water use does not increase in 2050 because the water supply is only moved from one use to another, not increased. Figure 56 shows that Scenario 1 would not meet all demands (including agricultural) under various drought conditions, as described at the beginning of Section 7.2

Figure 57 illustrates Scenario 2 for the Northern Subregion, in which the supply/demand gap is met entirely through the use of SJC water and a reduction in total demand of 25 percent (five squares for the conservation alternative) or a reduction in the projected demand increase of 50 percent (five squares for the growth management alternative). The demand reduction could occur through a combination of growth management or conservation measures. Under this scenario, municipal wells are rested as long as SJC water is able to meet the demands of the region. Under drought conditions, the wells could be used to meet the gap between the supply and demand (Figure 58).

7.2.2 Scenarios and Options for the Aamodt Subregion

Under the most-likely population projection provided by BBER (2000), the estimated projected increase in population for the Aamodt Subregion is 41,700 people, from an approximate 11,100 in 2000 to an estimated 52,800 in 2060. This population increase could result in an increase in water demand from 1,671 afy in 2000 to 7,921 afy in 2060, an increase of 6,250 afy. Figure 59 shows the current sources of water supply and the projected increase in demand. Options for meeting this projected gap between supply and demand are shown in the option chart in Figure

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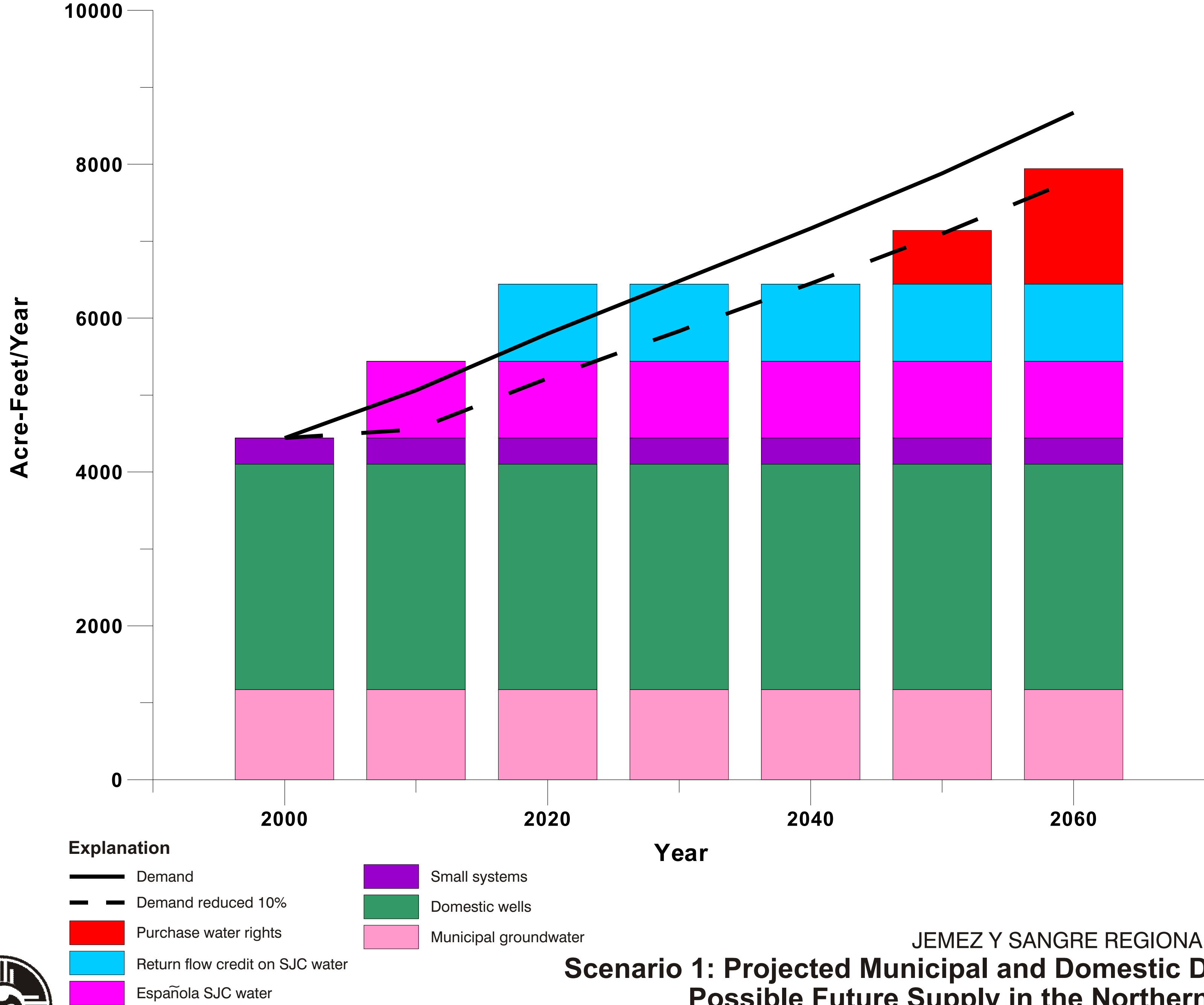

JEMEZ Y SANGRE REGIONAL WATER PLAN

Scenario 1: Projected Municipal and Domestic Demand and Possible Future Supply in the Northern Subregion

Figure 53

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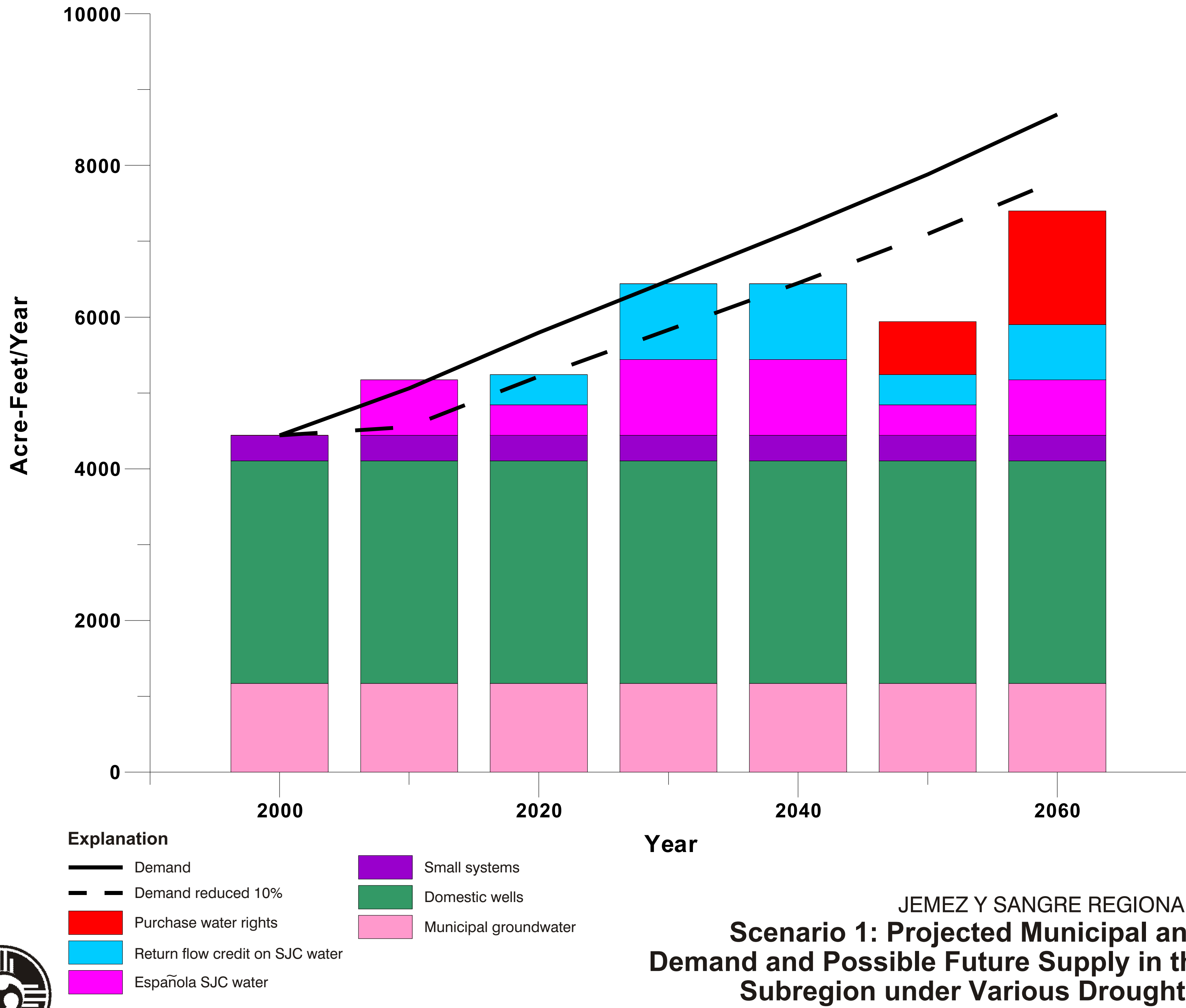

JEMEZ Y SANGRE REGIONAL WATER PLAN

Scenario 1: Projected Municipal and Domestic Demand and Possible Future Supply in the Northern Subregion under Various Drought Conditions

Figure 54

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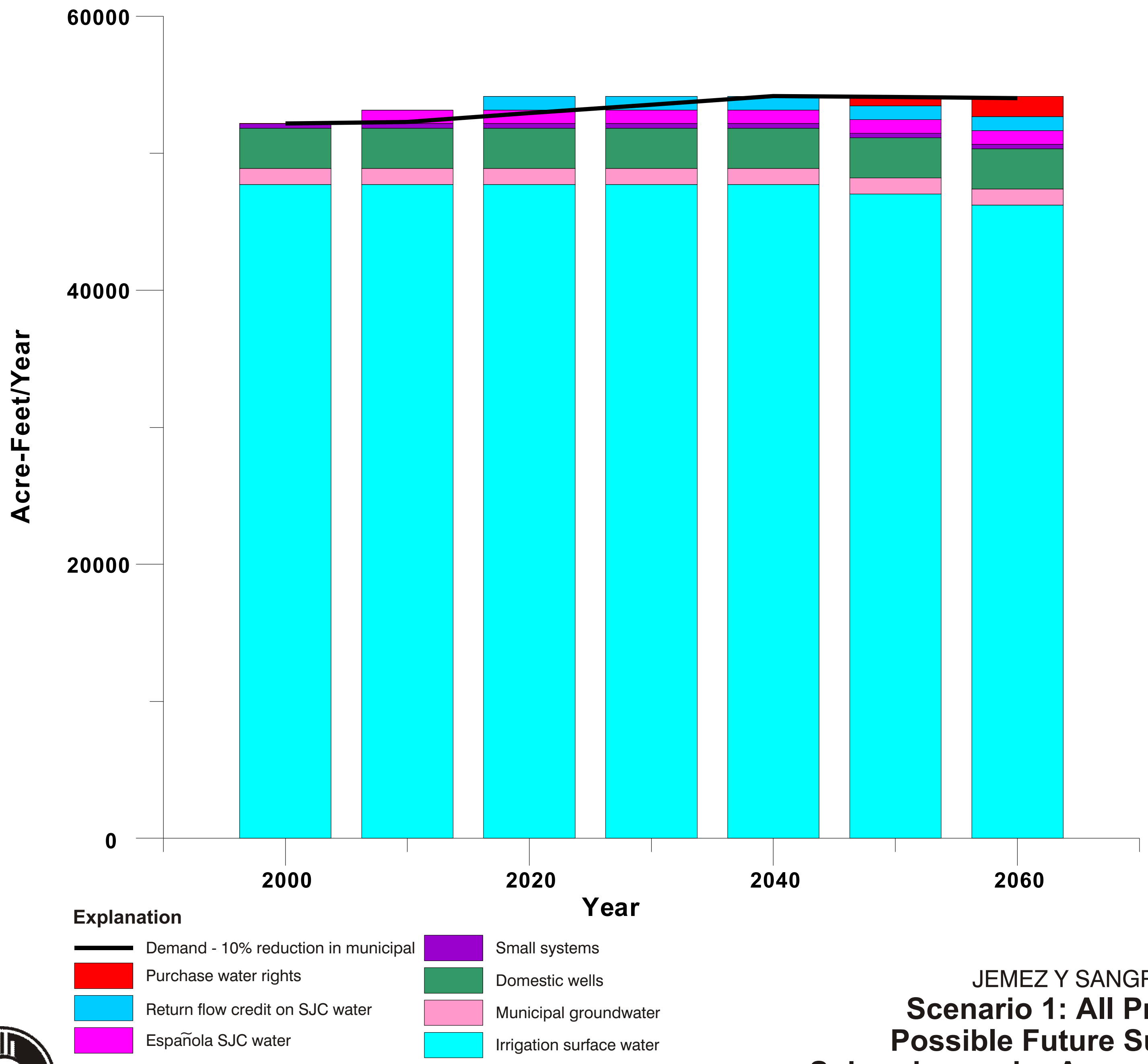
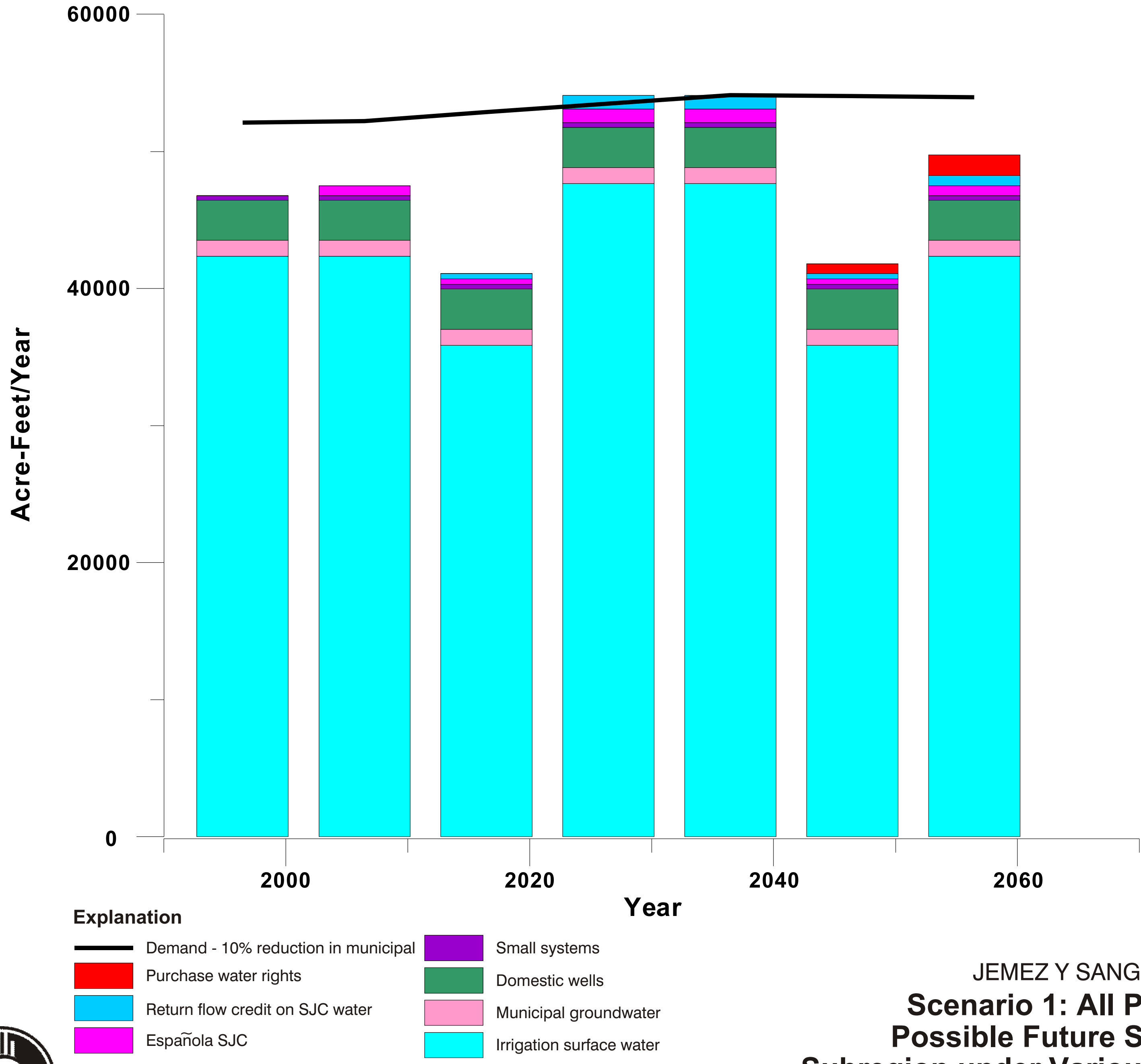


JEMEZ Y SANGRE REGIONAL WATER PLAN

Scenario 1: All Projected Demand and Possible Future Supply in the Northern Subregion under Average Supply Conditions

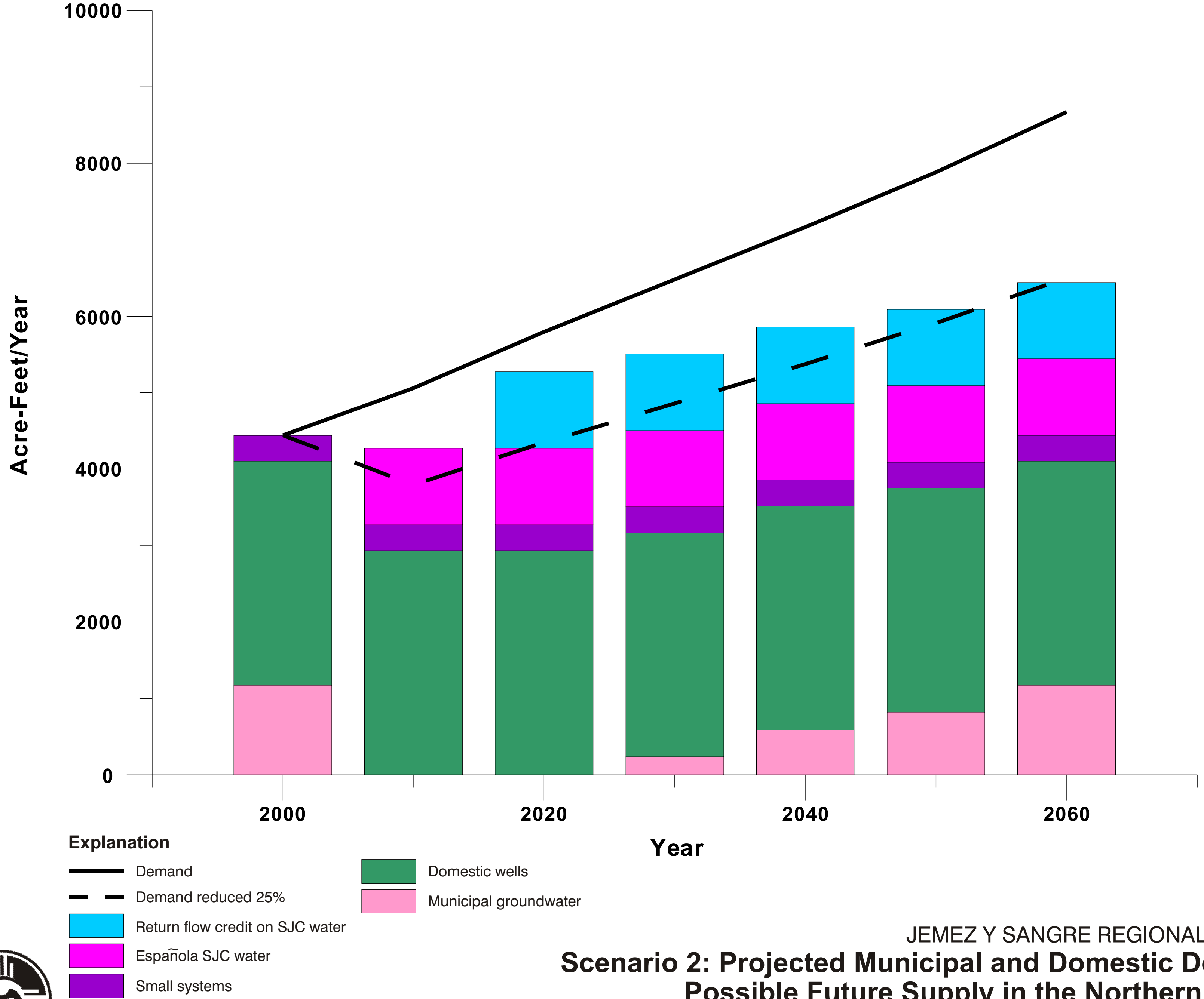
Figure 55



JEMEZ Y SANGRE REGIONAL WATER PLAN

Scenario 1: All Projected Demand and Possible Future Supply in the Northern Subregion under Various Drought Conditions

Figure 56



JEMEZ Y SANGRE REGIONAL WATER PLAN

Scenario 2: Projected Municipal and Domestic Demand and Possible Future Supply in the Northern Subregion

Figure 57

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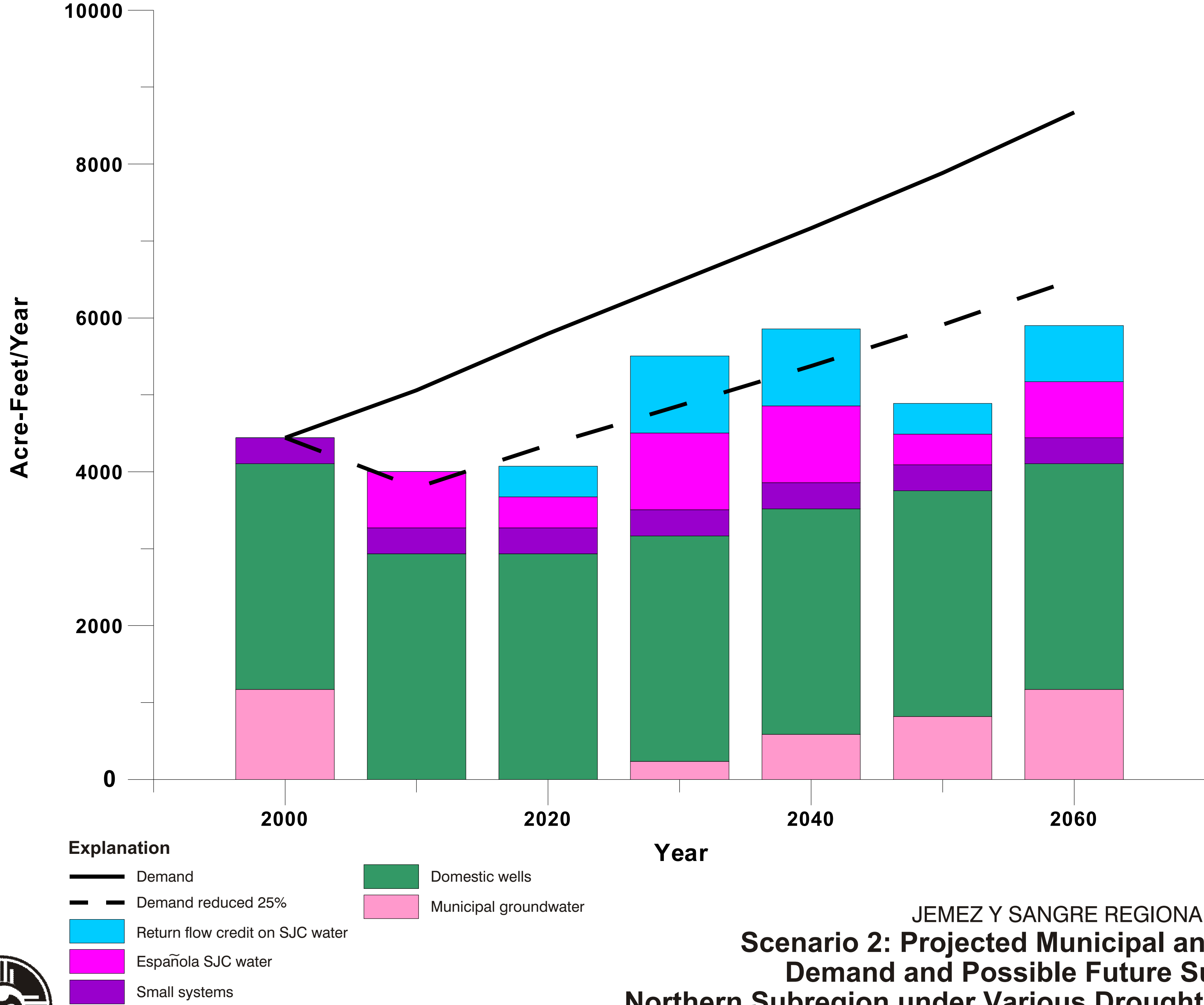

JEMEZ Y SANGRE REGIONAL WATER PLAN

Scenario 2: Projected Municipal and Domestic Demand and Possible Future Supply in the Northern Subregion under Various Drought Conditions

Figure 58

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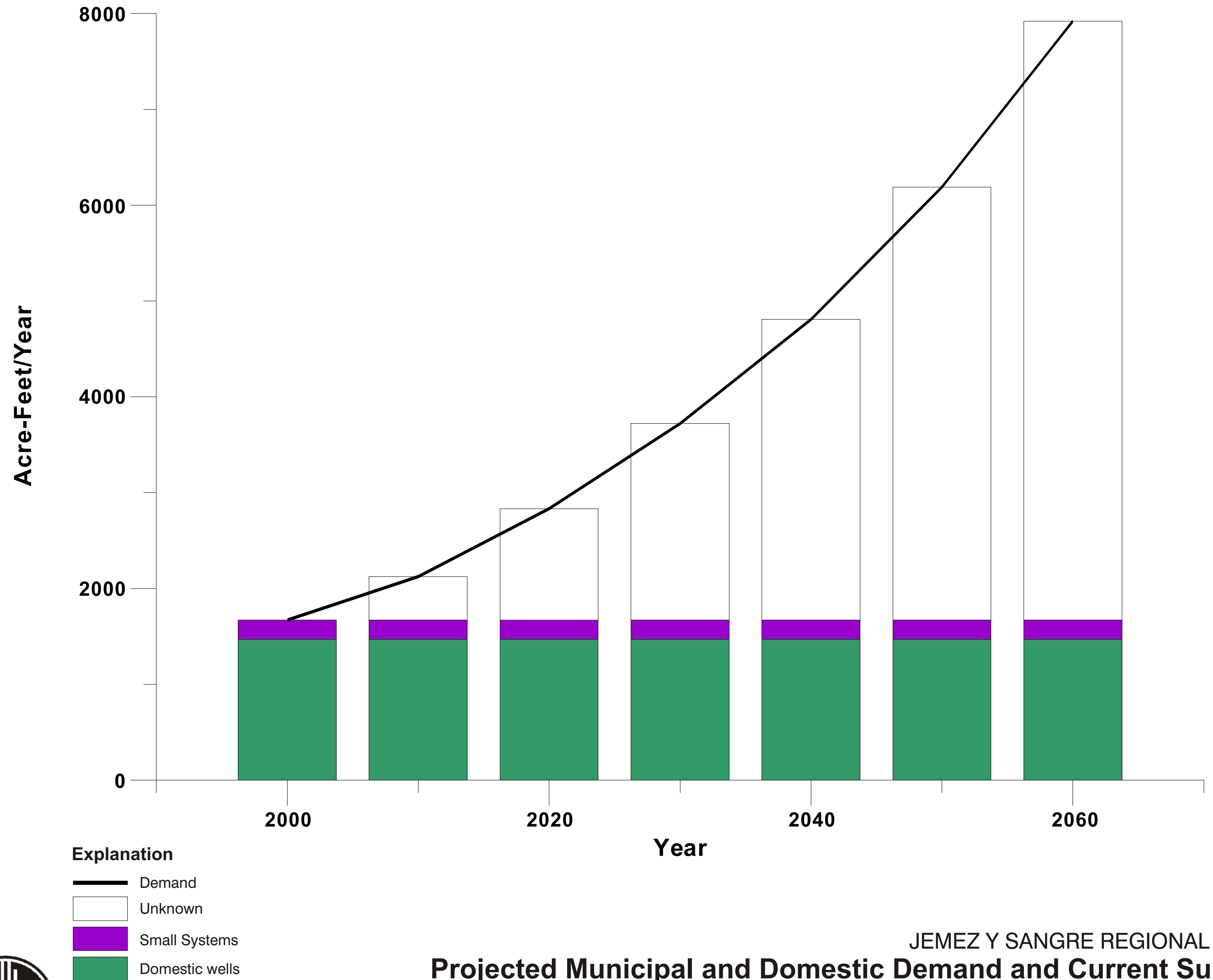

JEMEZ Y SANGRE REGIONAL WATER PLAN

Projected Municipal and Domestic Demand and Current Supply in the Aamodt Subregion under Average Supply Conditions

Figure 59

60. As explained in Section 7.2.1, each square in the options chart represents 10 percent of the projected gap by the year 2060. Therefore, the options chart can be utilized to develop potential scenarios for closing the gap by selecting squares that total 100 percent.

In the Aamodt Subregion, Scenario 1 would meet this gap through (1) using water rights made available through replacement rights, (2) reducing water demand through conservation, and (3) transferring some water from agriculture to urban use as (Figure 61). However, during periods of drought, certain surface water supplies (e.g., water from the transfer of irrigation rights) may not be available, resulting in a gap between supply and demand. Figure 62 illustrates such a gap in 2060, if no conservation measures are implemented. The replacement rights represent water produced from groundwater. Figure 63 shows how Scenario 1 could be used to meet all water demand (including agriculture). Note that the total water use does not increase in 2050, where water is only moved from one use to another. Figure 64 shows that Scenario 1 would not meet all demand (including agricultural demand) under various drought conditions. The impact of reduced streamflows from the increased groundwater pumping for the replacement rights is not included in these graphs.

Figure 65 illustrates Scenario 2 for the Aamodt Subregion. In this scenario, the supply/demand gap is met entirely through use of replacement rights (groundwater production) and greater conservation measures. Under drought conditions, the water supply under Scenario 2 would remain unchanged (with no consideration of long-term impacts from reduced recharge to the aquifers).

7.2.3 Scenarios and Options for the Santa Fe Subregion

Under the most-likely population projection provided by BBER (2000), the estimated projected increase in population for the Santa Fe Subregion (including Santa Fe, Caja del Rio, and North Galisteo Sub-Basins) is 109,700 people, from approximately 99,300 in 2000 to 209,000 in 2060. As a result, water demand could increase by approximately 19,900 afy, from 16,600 afy in 2000 to 36,500 afy in 2060. Figure 66 shows the current sources of water supply and the projected increase in demand. Options for meeting this projected gap between supply and demand are shown in the option chart in Figure 67. As explained in Section 7.2.1, each square in the

Percent	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
Acre-Feet	*625*	*1,250*	*1,875*	*2,500*	*3,125*	*3,750*	*4,375*	*5,000*	*5,625*	*6,250*
Conservation	Reduce ***NEW*** indoor and outside demand by 10%	Reduce ***NEW*** indoor and outside demand by 25%	Reduce ***ALL*** outside use and ***NEW*** inside use by 25%	Reduce ***ALL*** outside use by 50% and all ***NEW*** inside use by 25%	Reduce ***ALL*** outside use by 70% and all ***NEW*** inside use by 25%					
Growth Management	Reduce projected growth rate by 10%	Reduce projected growth rate by 20%	Reduce projected growth rate by 30%	Reduce projected growth rate by 40%	Reduce projected growth rate by 50%					
Transfer Agricultural Water Rights Below Otowi to Municipal Use	200 acres of MRGCD (0.4% of agric. land)	400 acres of MRGCD (0.7% of agric. land)	600 acres of MRGCD (1% of agric. land)	800 acres of MRGCD (1.4% of agric. land)	1,000 acres of MRGCD (1.7% of agric. land)	1,200 acres of MRGCD (2.1% of agric. land)	1,400 acres of MRGCD (2.4% of agric. land)	1,600 acres of MRGCD (2.8% of agric. land)	1,800 acres of MRGCD (3.1% of agric. land)	2,000 acres of MRGCD (3.5 % of agric. land)
Transfer Agricultural Water Rights Above Otowi to Municipal Use	480 acres (2.4% of JyS agric. land)	690 acres (4.8% of JyS agric. land)	1,440 acres (7% of JyS agric. land)	1,900 acres (10% of JyS agric. land)	2,400 acres (12% of JyS agric. land)	2,900 acres (15% of JyS agric. land)	3,400 acres (17% of JyS agric. land)	3,800 acres (19% of JyS agric. land)	4,300 acres (22% of JyS agric. land)	4,800 acres (24% of JyS agric. land)
Allow More Domestic Wells										
Utilize San Juan-Chama Water	Lease Jicarilla Apache SJC water	Lease Jicarilla Apache SJC water	Lease Jicarilla Apache SJC water	Lease Jicarilla Apache SJC water	Lease Jicarilla Apache SJC water	Return flow credit on Jicarilla Apache SJC water	Return flow credit on Jicarilla Apache SJC water	Return flow credit on Jicarilla Apache SJC water	Return flow credit on Jicarilla Apache SJC water	Return flow credit on Jicarilla Apache SJC water

Select ten blocks, starting on the left, from a combination of alternatives to indicate the desired method of reducing the projected 2060 gap between supply and demand. (Selection of any one block requires selection of all blocks to the left in that alternative.)

100% = 6,250 acre-feet

(hatched) = No further reduction in supply/demand gap is viable with this alternative

(yellow) = Uncertain due to the requirement to modify compact accounting and Area of Origin concerns

JEMEZ Y SANGRE REGIONAL WATER PLAN

Options for Meeting Projected Supply/Demand Gap in the Aamodt Subregion

Figure 60

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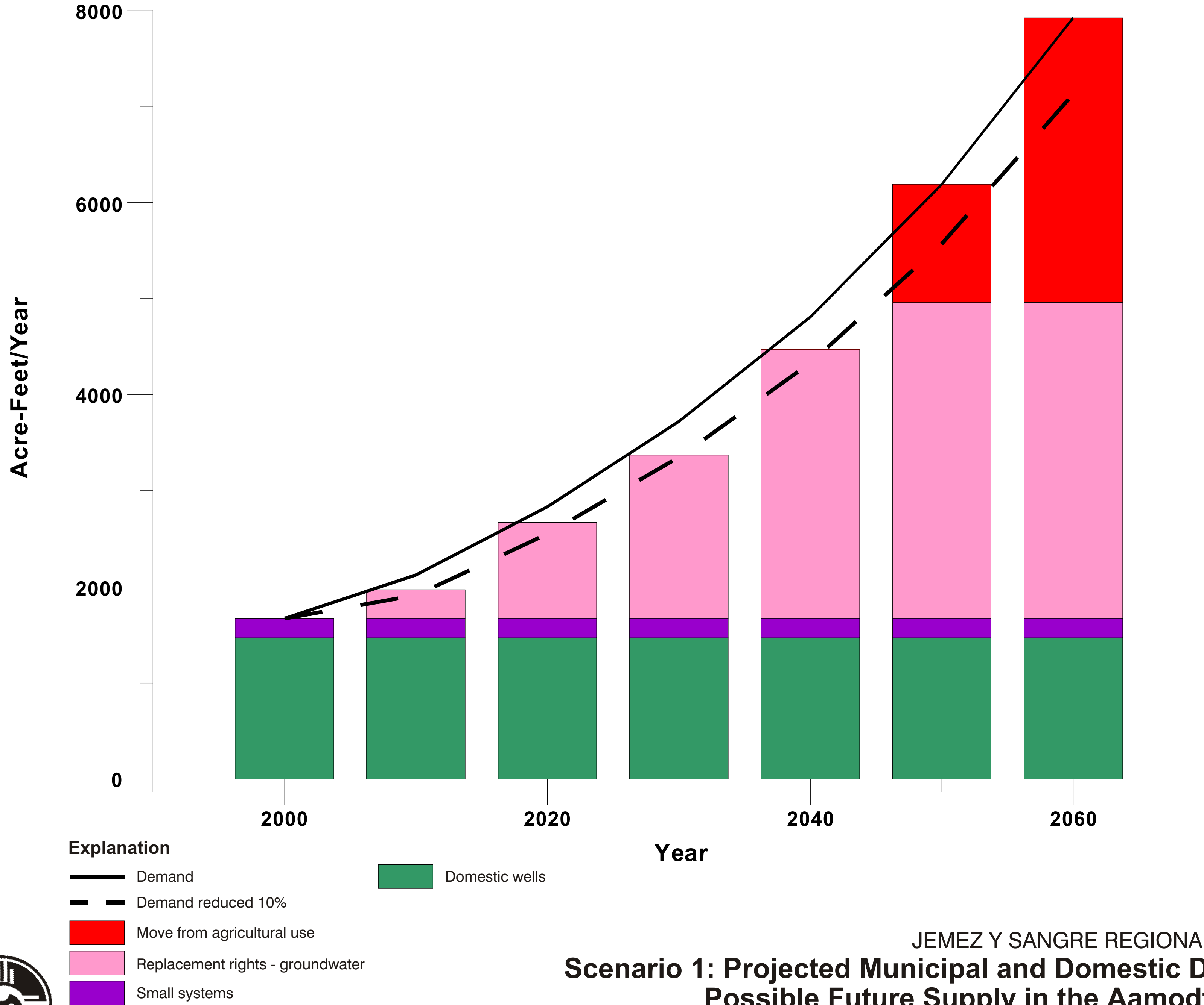
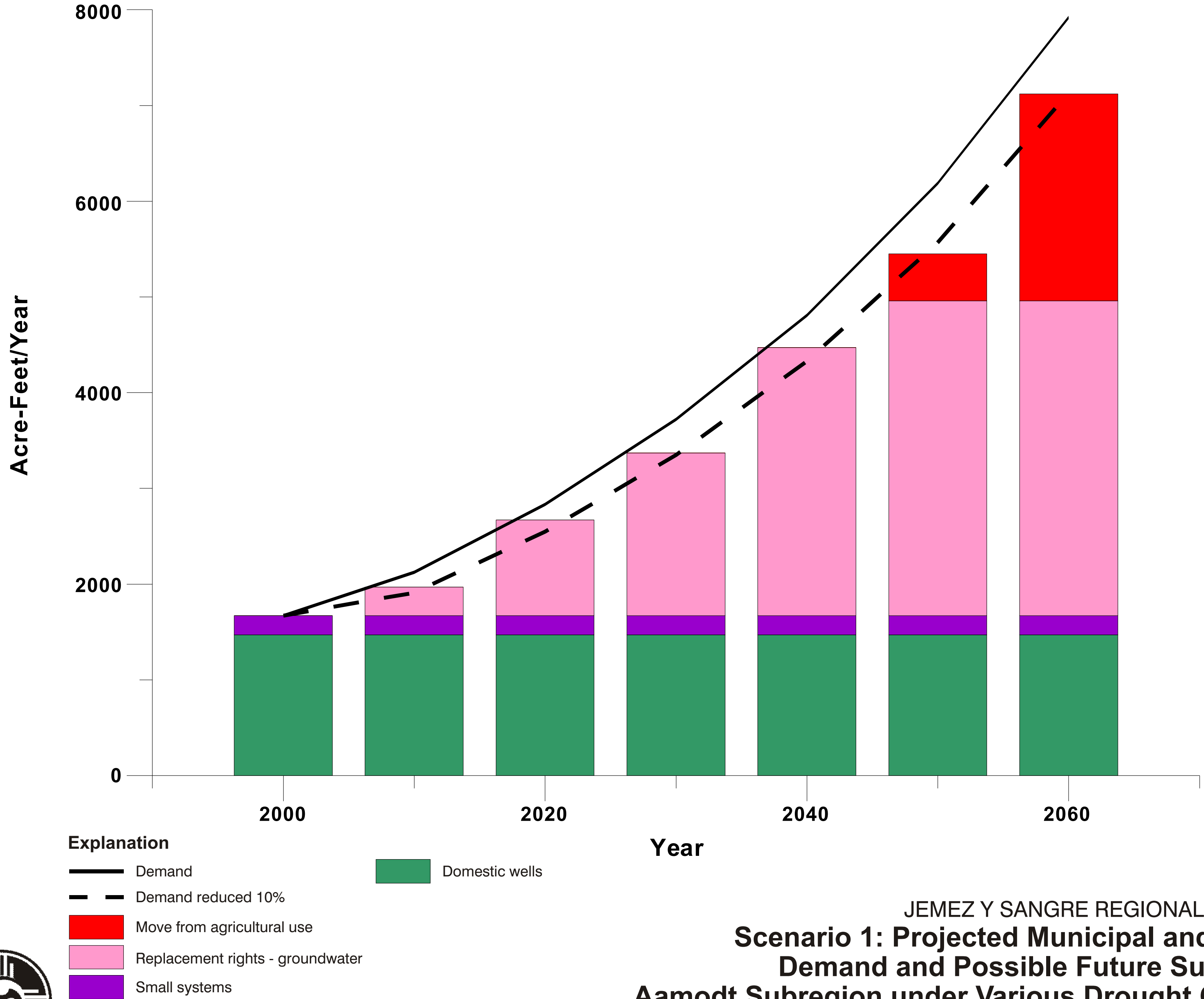


JEMEZ Y SANGRE REGIONAL WATER PLAN

Scenario 1: Projected Municipal and Domestic Demand and Possible Future Supply in the Aamodt Subregion

Figure 61



JEMEZ Y SANGRE REGIONAL WATER PLAN

Scenario 1: Projected Municipal and Domestic Demand and Possible Future Supply in the Aamodt Subregion under Various Drought Conditions

Figure 62

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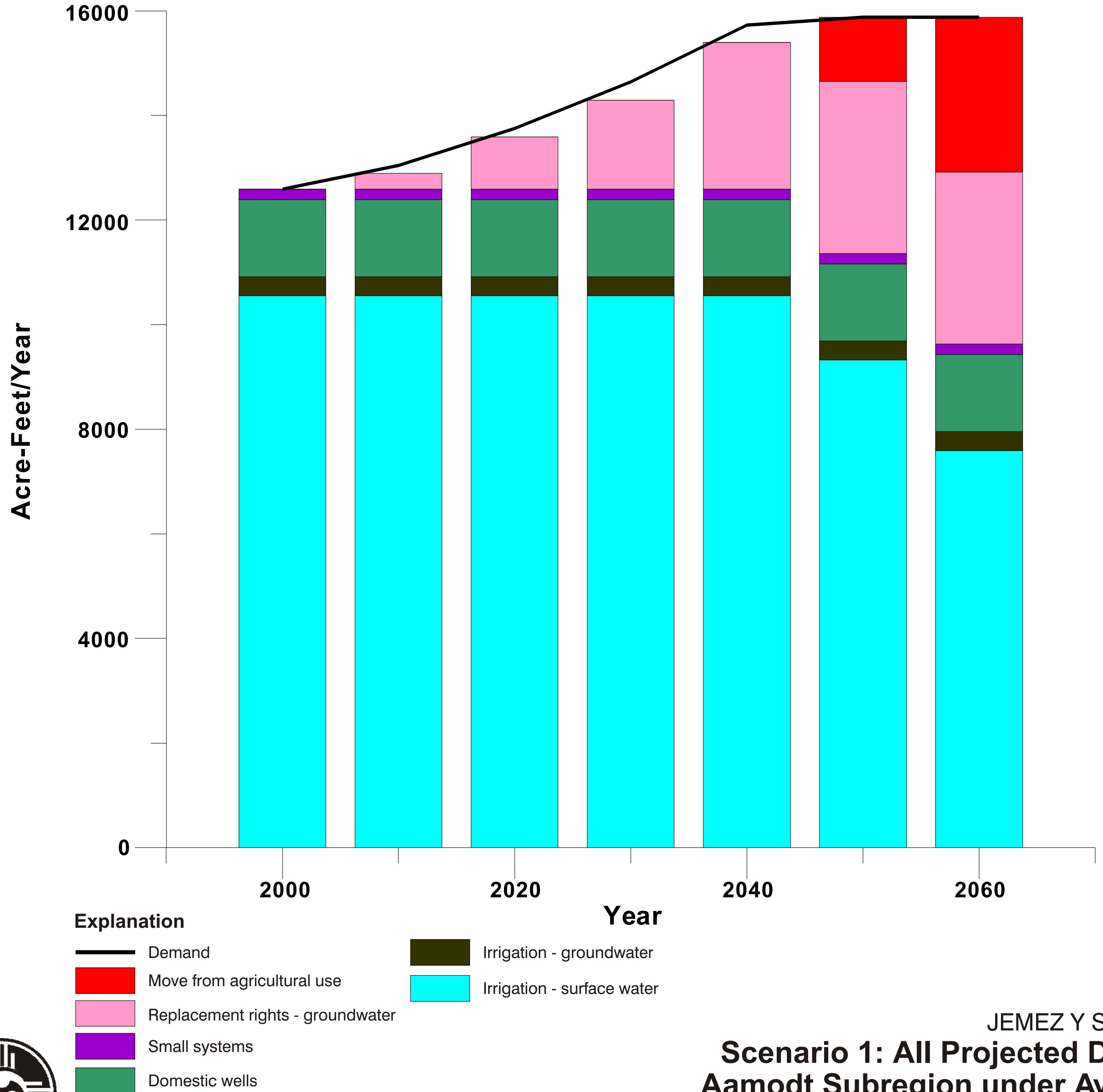

JEMEZ Y SANGRE REGIONAL WATER PLAN

Scenario 1: All Projected Demand and Supply in the Aamodt Subregion under Average Supply Conditions

Figure 63

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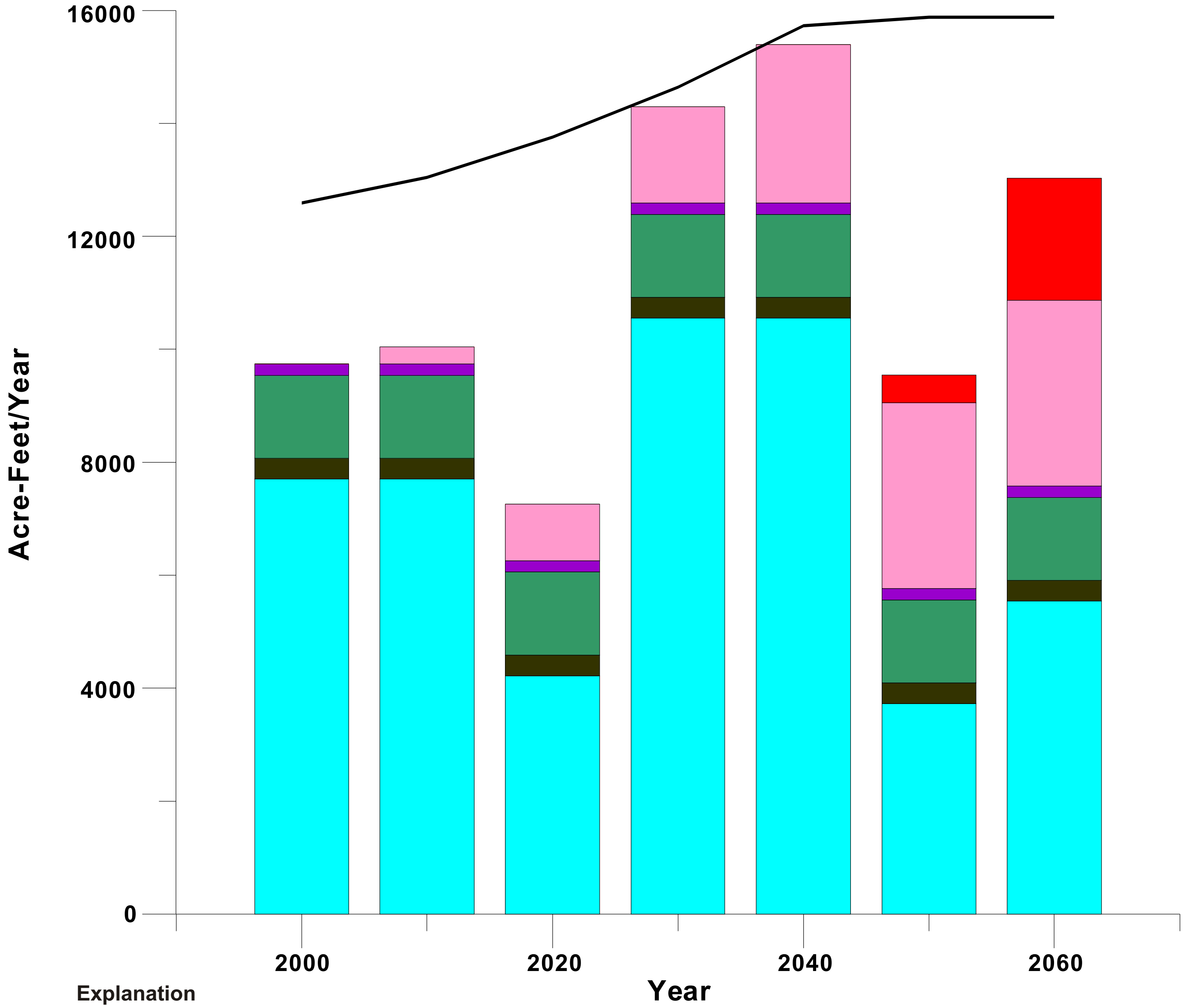

Explanation

- Demand
- Move from agricultural use
- Replacement rights - groundwater
- Small systems
- Domestic wells
- Irrigation - groundwater
- Irrigation - surface water

JEMEZ Y SANGRE REGIONAL WATER PLAN

Scenario 1: All Projected Demand and Supply in the Aamodt Subregion under Various Drought Conditions

Figure 64

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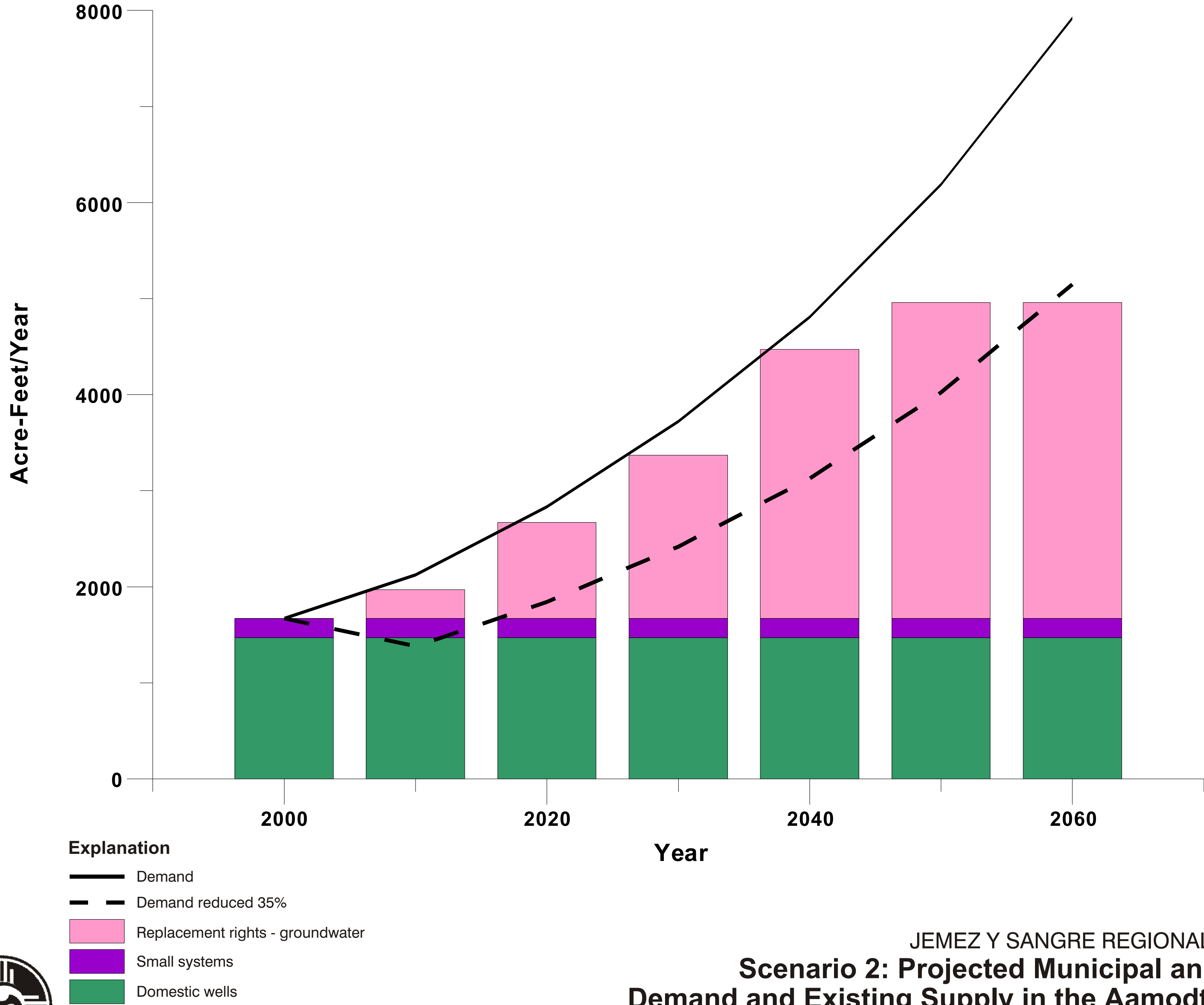

JEMEZ Y SANGRE REGIONAL WATER PLAN

Scenario 2: Projected Municipal and Domestic Demand and Existing Supply in the Aamodt Subregion

Figure 65

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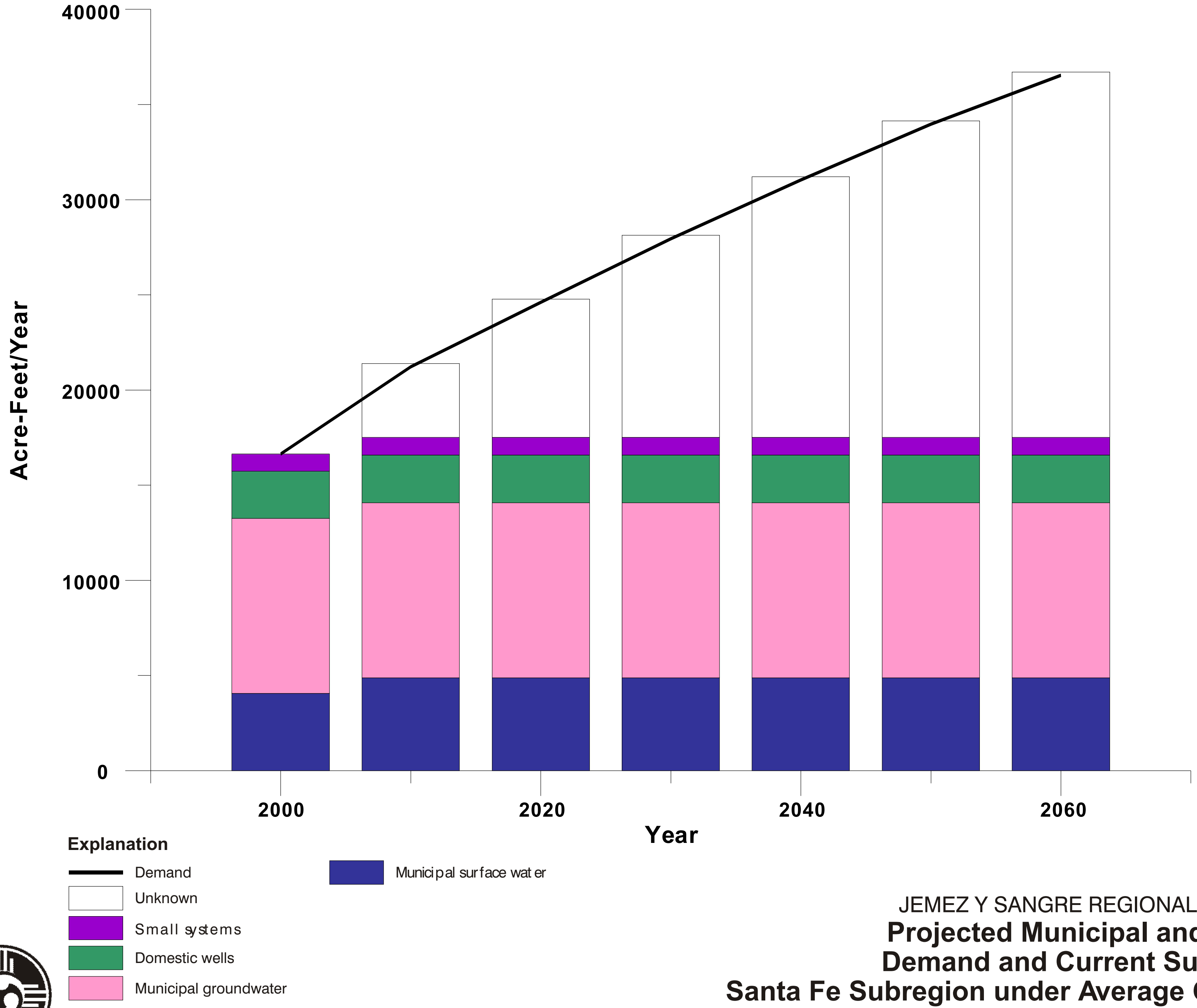

JEMEZ Y SANGRE REGIONAL WATER PLAN

Projected Municipal and Domestic Demand and Current Supply in the Santa Fe Subregion under Average Conditions

Figure 66

Percent	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
Acre-Feet	*1,990*	*3,980*	*5,970*	*7,960*	*9,950*	*11,940*	*13,930*	*15,920*	*17,910*	*19,900*
Conservation	Reduce ***NEW*** indoor and outside demand by 10%	Reduce ***NEW*** indoor and outside demand by 25%	Reduce ***ALL*** outside use and ***NEW*** inside use by 25%	Reduce ***ALL*** outside use by 50% and all ***NEW*** inside use by 25%	Reduce ***ALL*** outside use by 70% and all ***NEW*** inside use by 25%					
Growth Managric.ement	Reduce projected growth rate by 10%	Reduce projected growth rate by 20%	Reduce projected growth rate by 30%	Reduce projected growth rate by 40%	Reduce projected growth rate by 50%					
Transfer Agricultural Water Rights Below Otowi to Municipal Use	640 acres of MRGCD (1% of agric. land)	1,300 acres of MRGCD (2% of agric. land)	1,900 acres of MRGCD (3% of agric. land)	2,600 acres of MRGCD (4% of agric. land)	3,200 acres of MRGCD (5.5% of agric. land)	3,850 acres of MRGCD (6.6% of agric. land)	4,500 acres of MRGCD (8% of agric. land)	5,100 acres of MRGCD (9% of agric. land)	5,800 acres of MRGCD (10% of agric. land)	6,400 acres of MRGCD (11 % of agric. land)
Transfer Agricultural Water Rights Above Otowi to Municipal Use	1,500 acres (7.7% of JyS agric. land)	3,000 acres (15% of JyS agric. land)	4,600 acres (23% of JyS agric. land)	6,100 acres (31% of JyS agric. land)	7,700 acres (38% of JyS agric. land)					
Allow More Domestic Wells	8,000 more households on domestic wells									
Utilize San Juan-Chama Water	Return flow credit on City of Santa Fe SJC water	Return flow credit on City of Santa Fe SJC water	Lease Jicarilla Apache SJC water	Lease Jicarilla Apache SJC water	Return flow credit on Jicarilla Apache SJC water					

Select ten blocks, starting on the left, from a combination of alternatives to indicate the desired method of reducing the projected 2060 gap between supply and demand. (Selection of any one block requires selection of all blocks to the left for that alternative.)

100% = 19,900 acre-feet

= No further reduction in supply/demand gap is viable with this alternative

= Uncertain due to the requirement to modify compact accounting

= Uncertain due to Area of Origin concerns

JEMEZ Y SANGRE REGIONAL WATER PLAN

Options for Meeting Projected Supply/Demand Gap in the Santa Fe Subregion

Figure 67

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options chart represents 10 percent of the projected gap by the year 2060. Therefore, the options chart can be utilized to develop potential scenarios for closing the gap by selecting ten squares that total 100 percent.

In the Santa Fe Area Subregion, Scenario 1 would close the gap through a combination of actions, including (1) using SJC water, (2) reducing water demand by 25 percent through conservation, and (3) transferring some water from agriculture to urban use (Figure 68). In this scenario, reliance on groundwater would be dramatically reduced, from about 9,000 acre-feet to about 1,000 acre-fee coming from municipal wells. During periods of drought, when surface water supplies are less reliable, groundwater could be used to meet the projected gap (Figure 69).

Figure 70 illustrates Scenario 2 for the Santa Fe Subregion. In this scenario, the supply/demand gap is met entirely through the use of greater conservation measures (35 percent reduction) and the use of SJC water. Under drought conditions, groundwater would be used to meet the gap presented by diminished surface water supplies, as shown in Figure 71.

7.2.4 Scenario for the Los Alamos Sub-Basin

Under the most-likely population projection provided by BBER (2000), population in the Los Alamos Sub-Basin is projected to increase by approximately 2,700 people between 2000 and 2060, from an approximate 19,500 in 2000 to 22,200 in 2060. The resultant increase in water demand is approximately 523 afy from 4012 afy in 2000 to 4,535 afy in 2060. Figure 72 shows the current sources of water supply and the projected increase in demand. Options for meeting this projected increase in demand include pumping more water from the aquifer or developing conservation measures. Because the increase in demand is very small, no option chart was developed for this sub-basin. Groundwater modeling by Keating indicates that existing groundwater supplies should be able to support the current and projected level of pumping for an indefinite period.

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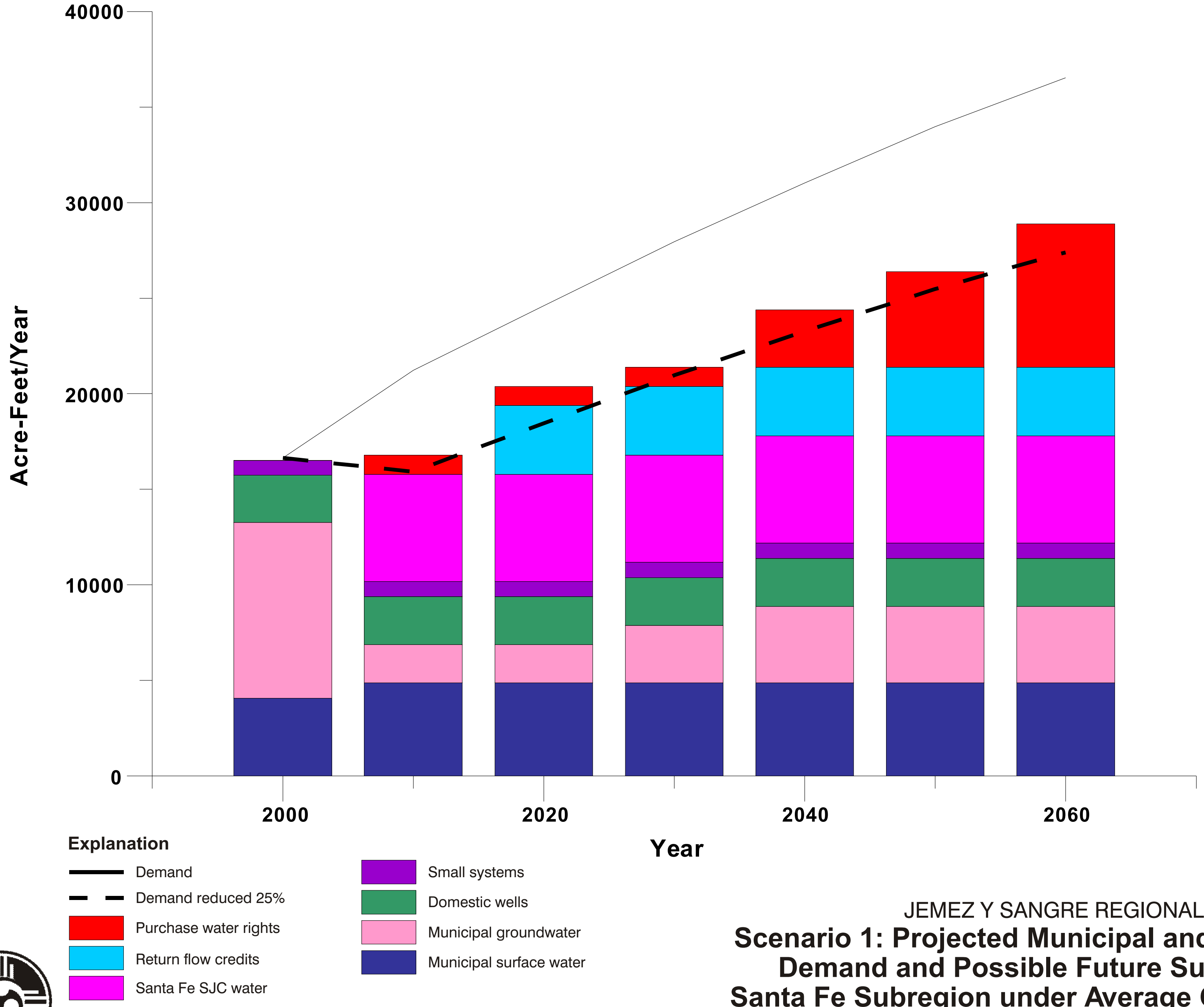

JEMEZ Y SANGRE REGIONAL WATER PLAN

Scenario 1: Projected Municipal and Domestic Demand and Possible Future Supply in the Santa Fe Subregion under Average Conditions

Figure 68

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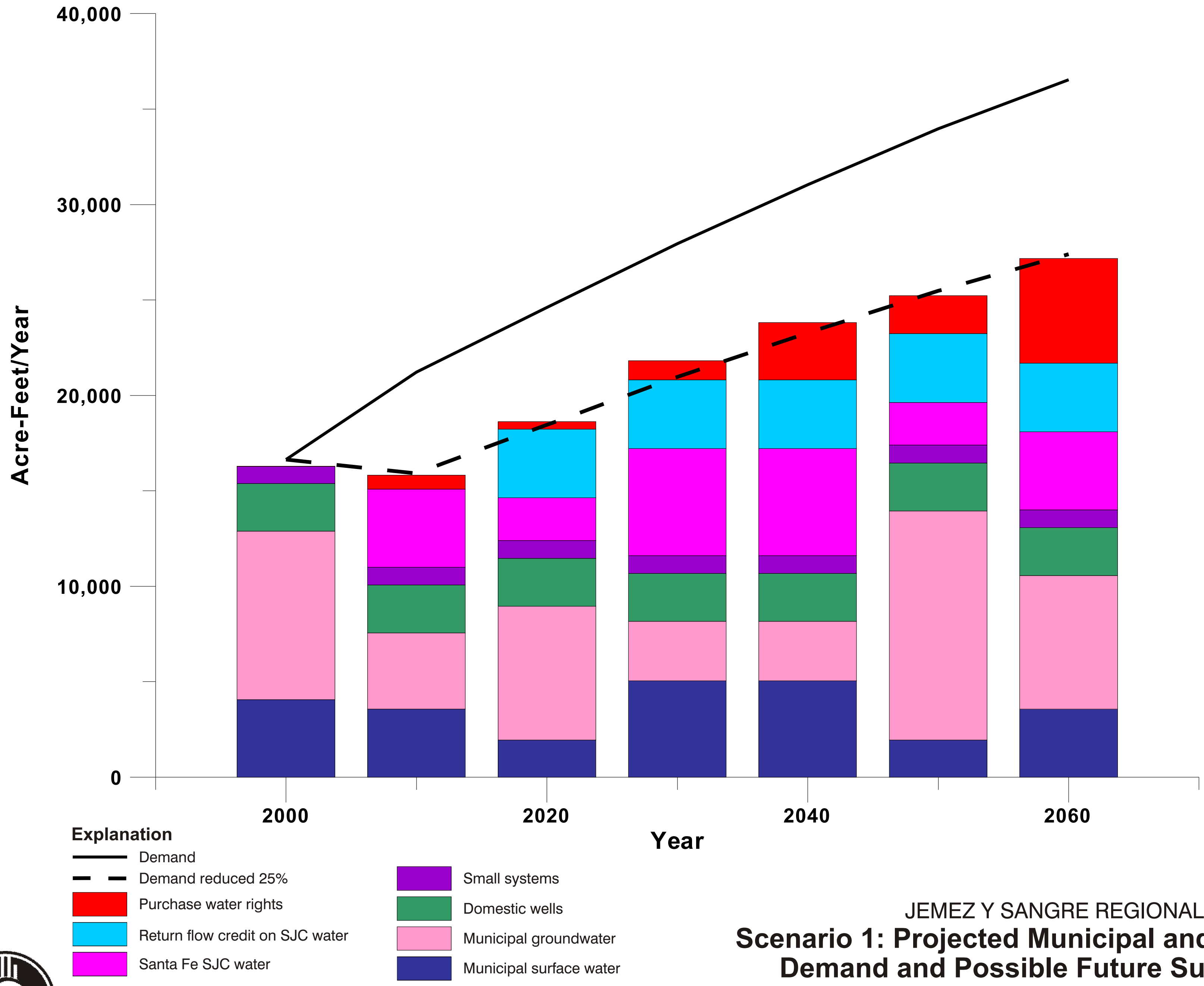

JEMEZ Y SANGRE REGIONAL WATER PLAN

Scenario 1: Projected Municipal and Domestic Demand and Possible Future Supply in the Santa Fe Subregion under Various Drought Conditions

Figure 69

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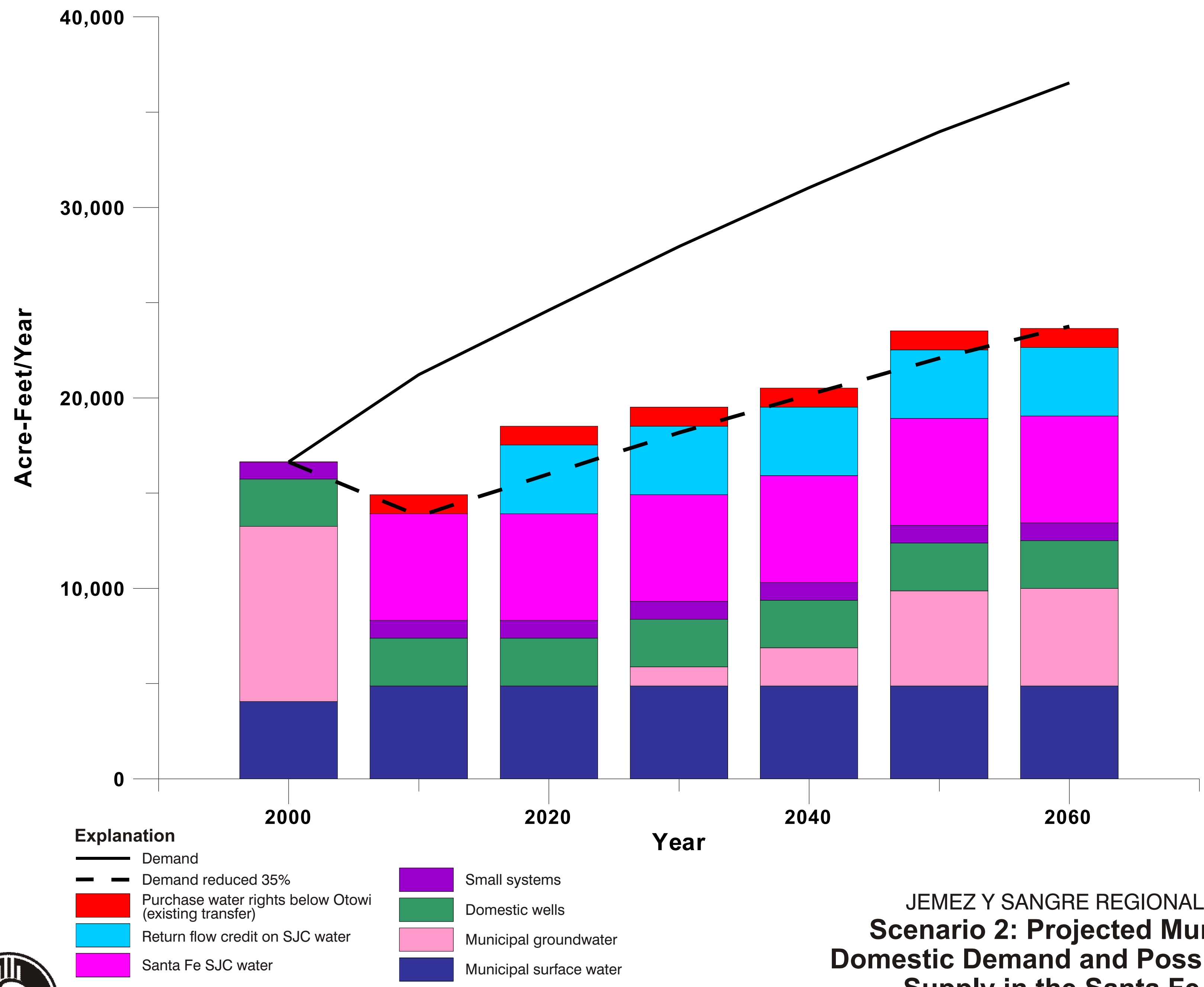

JEMEZ Y SANGRE REGIONAL WATER PLAN

Scenario 2: Projected Municipal and Domestic Demand and Possible Future Supply in the Santa Fe Subregion

Figure 70

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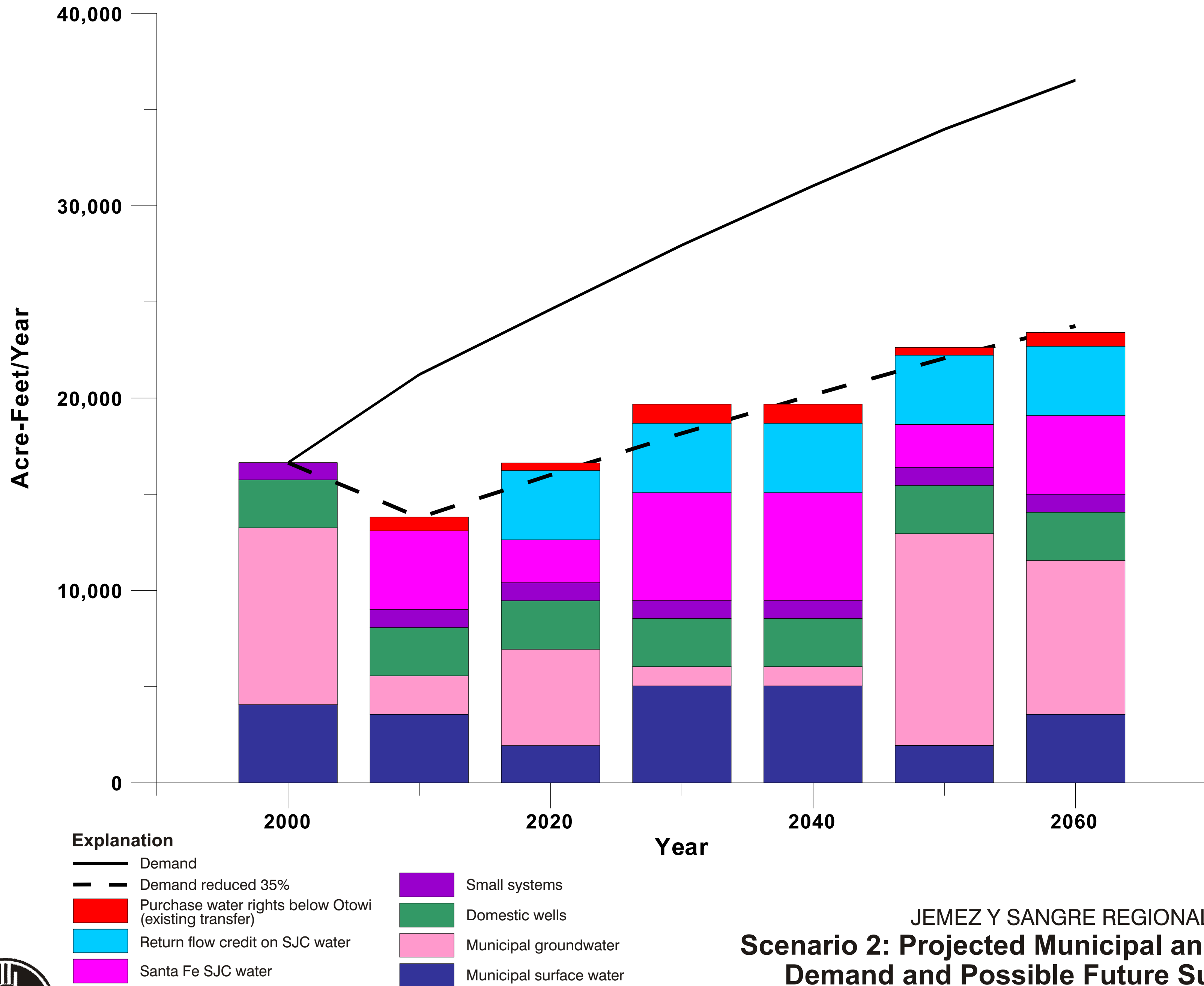

JEMEZ Y SANGRE REGIONAL WATER PLAN

Scenario 2: Projected Municipal and Domestic Demand and Possible Future Supply in the Santa Fe Subregion under Various Drought Conditions

Figure 71

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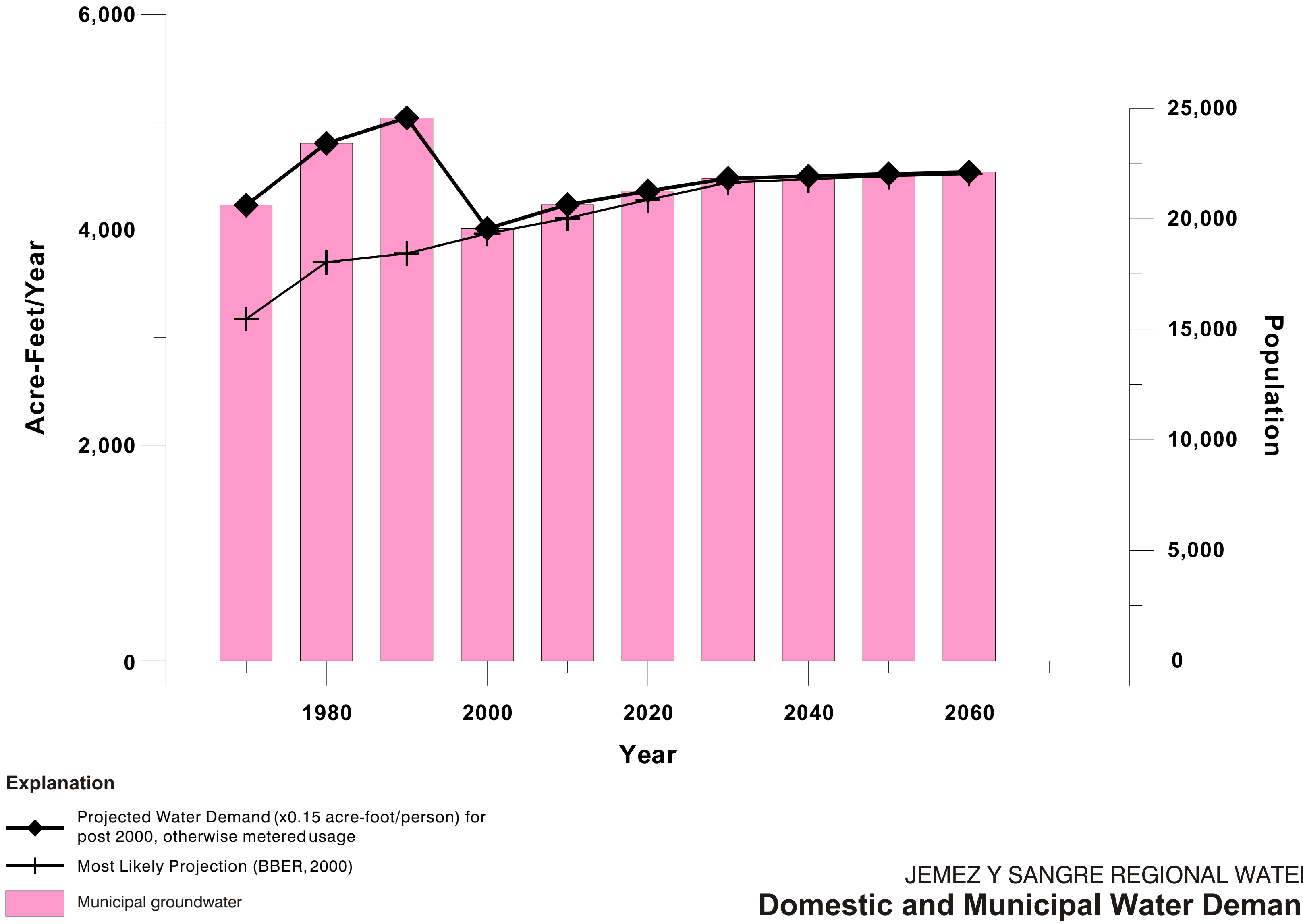

JEMEZ Y SANGRE REGIONAL WATER PLAN

Domestic and Municipal Water Demand and Current Supply in the Los Alamos Sub-Basin

Figure 72

7.2.5 Scenario for the South Galisteo Sub-Basin

Under the most-likely population projection provided by BBER (2000), the projected population increase for the South Galisteo Sub-Basin is approximately 12,400 people, from approximately 2,900 in 2000 to 15,300 in 2060. This population increase could result in an increase in water demand from 435 afy in 2000 to 2,291 afy in 2060, a total increase of 1,860 afy. Figure 73 shows the current sources of water supply and the projected increase in demand. Options for meeting this projected gap between supply and demand are shown in the option chart in Figure 74. As explained in Section 7.2.1, each square in the options chart represents 10 percent of the projected gap by the year 2060. Therefore, the options chart can be utilized to develop potential scenarios for closing the gap by selecting ten squares that total 100 percent.

In the South Galisteo Sub-Basin, few options are available for increasing the water supply. Without the economic base to drive an expensive imported water project, the gap could only be closed by reducing water demand through conservation or growth management. Figure 73 shows different levels of demand reduction. It is possible that some water supply could be made available through domestic wells; however this is highly uncertain given the geology of the area.

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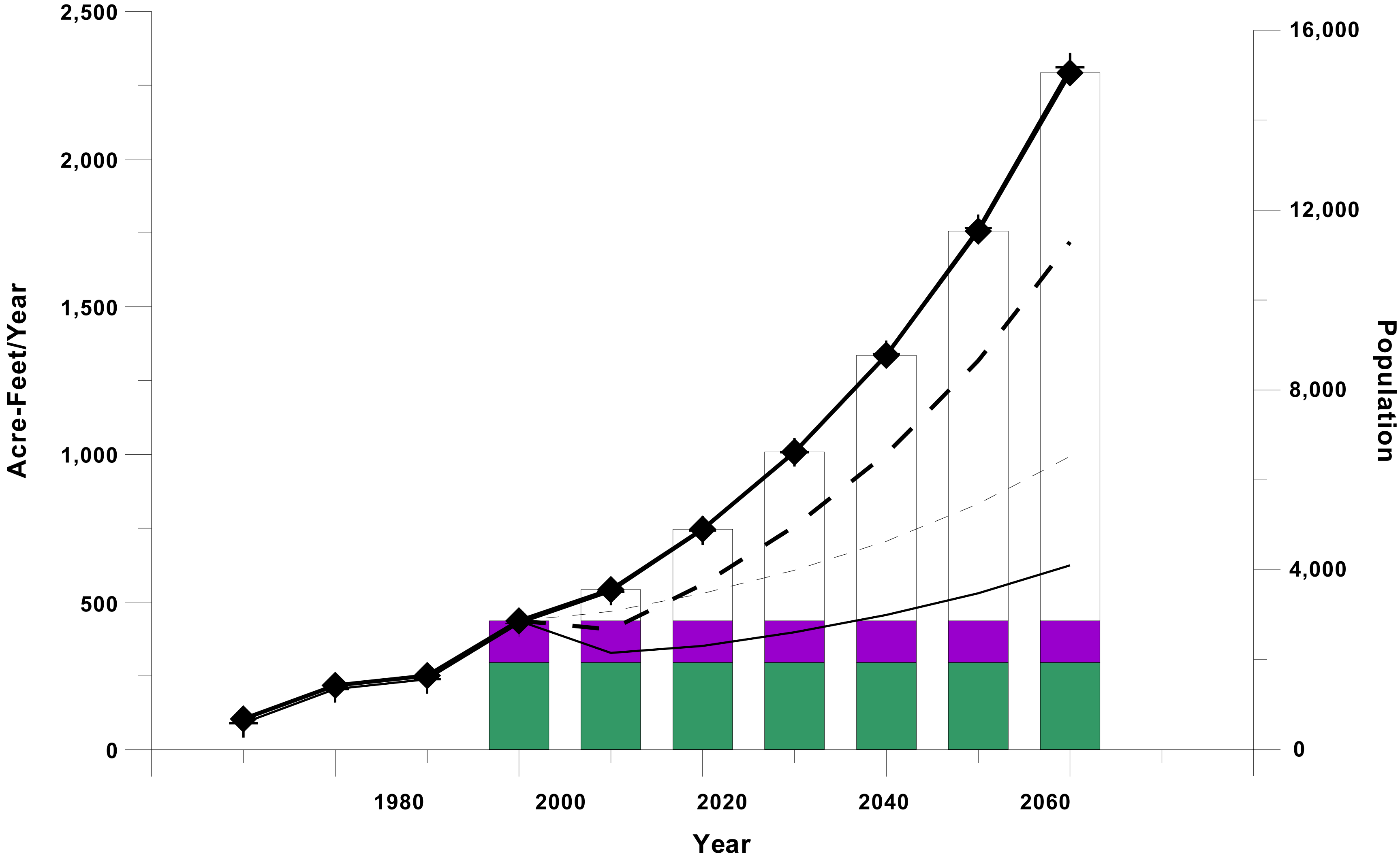

Explanation

- Projected Water Demand (x0.15 acre-foot/person)
- Most Likely Population Projection (BBER, 2000)
- Demand reduced 25% through conservation (by 0.11 acre-foot/person)
- Demand reduced through growth management
- Demand reduced through growth management and conservation
- Unknown
- Other metered wells
- Domestic wells

JEMEZ Y SANGRE REGIONAL WATER PLAN

Domestic and Municipal Water Demand and Current Supply in the South Galisteo Sub-Basin Showing Degrees of Demand Reduction

Figure 73

Percent	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**
Acre-Feet	*186*	*372*	*558*	*744*	*930*	*1,116*	*1,302*	*1,488*	*1,674*	*1,860*
Conservation	Reduce ***NEW*** indoor and outside demand by 10%	Reduce ***NEW*** indoor and outside demand by 25%	Reduce ***ALL*** outside use and ***NEW*** inside use by 25%	Reduce ***ALL*** outside use by 50% and all ***NEW*** inside use by 25%	Reduce ***ALL*** outside use by 70% and all ***NEW*** inside use by 25%					
Growth Management	Reduce projected growth rate by 10%	Reduce projected growth rate by 20%	Reduce projected growth rate by 30%	Reduce projected growth rate by 40%	Reduce projected growth rate by 50%					
Transfer Agricultural Water Rights Below Otowi to Municipal Use										
Transfer Agricultural Water Rights Above Otowi to Municipal Use										
Allow More Domestic Wells	744 More domestic wells	1,484 More domestic wells								
Utilize San Juan-Chama Water										

Select ten blocks, starting on the left, from a combination of alternatives to indicate the desired method of reducing the projected 2060 gap between supply and demand. (Selection of any one block requires selection of all blocks to the left in that alternative.)

100% = 1,860 acre-feet

[hatched box] = No further reduction in supply/demand gap is viable with this alternative

JEMEZ Y SANGRE REGIONAL WATER PLAN

Options for Meeting Projected Supply/Demand Gap in the South Galisteo Sub-Basin

Figure 74

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